

AD-A260 730



FIC
ECTE

FEB 23 1993

D

C

D

(2)

PACER SHARE Productivity and Personnel Management Demonstration

Second-Year Evaluation

Bruce R. Orvis, James R. Hosek, Michael G. Mattock

DISTRIBUTION STATEMENT A

Approved for public release
Distribution Unlimited

93-02797



161/88

92

RAND

NATIONAL DEFENSE
RESEARCH INSTITUTE

The research described in this report was sponsored by the Assistant Secretary of Defense (Force Management and Personnel). The research was conducted in the National Defense Research Institute, RAND's federally funded research and development center supported by the Office of the Secretary of Defense and the Joint Staff, Contract No. MDA903-90-C-0004.

Library of Congress Cataloging in Publication Data

Pacer share productivity and personnel management demonstration :
second year evaluation / Bruce R. Orvis . . . [et al.].

p. cm.

"R-4127-FMP."

"Prepared for the Assistant Secretary of Defense (Force Management and Personnel)."

Includes bibliographical references.

ISBN 0-8330-1208-8

1. Sacramento Air Logistics Center—Personnel management.

I. Orvis, Bruce R.

UG634.5.S23P33 1991

358.4'1411'0979454—dc20

91-38455

CIP

The RAND Publication Series: The Report is the principal publication documenting and transmitting RAND's major research findings and final research results. The RAND Note reports other outputs of sponsored research for general distribution. Publications of RAND do not necessarily reflect the opinions or policies of the sponsors of RAND research.

Published 1992 by RAND
1700 Main Street, P.O. Box 2138, Santa Monica, CA 90407-2138

R-4127-FMP

PACER SHARE Productivity and Personnel Management Demonstration

Second-Year Evaluation

Bruce R. Orvis, James R. Hosek, Michael G. Mattock
with Rebecca Mazel

DTIC QUALITY INSPECTED 3

Prepared for the
Assistant Secretary of Defense
(Force Management and Personnel)

Accession For	
NTIS CRA&I	<input checked="" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By	
Distribution /	
Availability Codes	
Dist	Avail and/or Special
A-1	

RAND

PREFACE

This report describes the PACER SHARE Productivity and Personnel Management Demonstration and the plan that has been developed to evaluate it. The report also presents statistical results concerning the quality of work life, organizational flexibility, work quality, and cost savings during the baseline period prior to the demonstration and through the demonstration's first two years.

PACER SHARE is a five-year demonstration being conducted at the Directorate of Distribution (DS) within the Sacramento Air Logistics Center (SM-ALC) under the legal authority of the Office of Personnel Management. Its purpose is to determine whether several changes in federal civil service practices being tried on an experimental basis will improve organizational productivity, flexibility, and quality of work life while sustaining (or improving) the quality and timeliness of work and the capability to mobilize during emergency or wartime. The DSs at the four remaining ALCs (which perform similar functions) serve as the comparison sites. The demonstration formally began in February 1988 after several years of planning. If effective, the interventions will subsequently be considered for wider application.

RAND is responsible for designing and carrying out the external evaluation of the project's results. These results should be of interest to the wide audience concerned with the improvement of the workplace within the public sector.

The study is funded by the U.S. Air Force through a special arrangement with the Assistant Secretary of Defense (Force Management and Personnel), the research sponsor. It is being carried out by the Defense Manpower Research Center, a component of RAND's National Defense Research Institute, a federally funded research and development center sponsored by the Office of the Secretary of Defense and the Joint Staff.

SUMMARY

The PACER SHARE Demonstration Project is a five-year federal civil service demonstration being conducted within the Directorate of Distribution (DS) at the Sacramento Air Logistics Center (ALC), under the legal authority of the Office of Personnel Management. In broad terms, the goals of PACER SHARE are to increase the flexibility of the organization to respond to changes in workload; to enrich the quality of work life; to maintain the quality and timeliness of work as these changes are being brought about and, in the long run, to make quality and timeliness even better; and to enhance productivity. The demonstration is designed to attain these objectives through several innovations in personnel practices and through productivity gainsharing, which returns one-half of cost savings to the work force. The personnel system changes include job series consolidation; revised base pay determination, including pay banding and elimination of individual performance appraisal; supervisory grading criteria changes that emphasize job responsibilities and deemphasize number of subordinates; and Demonstration On-Call hiring authority, which provides for rapid employee release and recall. Results in achieving PACER SHARE's goals are reported through spring 1990, after two years of the demonstration.

The improvement of organizational flexibility and quality of work life is measured through a series of survey and hard data (nonsurvey) measures. First, attitude changes among DS workers are measured in extensive annual surveys of the work forces at Sacramento and the other ALCs. Second, a battery of hard data measures addresses other changes. These measures are drawn primarily from the automated civilian personnel system. For example, we look at supervisor staffing and instances of multiple skill training to assess organizational flexibility and at turnover rates to address quality of work life.

Quality and timeliness of work are addressed through an evaluation of command-directed measures, including data on error rates maintained by the Quality Division of DS, reports of discrepancies, and measures of timeliness and support maintained by the Management Division. Finally, we assess changes in productivity by measures of personnel costs relative to output. The method we use is based on statistical estimates of the changes over time in personnel costs at Sacramento and the other ALCs, controlling for changes in output.

This method produces somewhat different results from the method used by DS at Sacramento to determine gainshares.

In each area our strategy is to identify changes that occur under PACER SHARE and to distinguish them from changes occurring in DS at the other ALCs during the same time period. This means establishing predemonstration (baseline) levels for all measures at Sacramento and the comparison sites, reassessing the measures annually to determine changes, and comparing the extent of change at Sacramento with that at the other ALCs so as to identify the effects unique to PACER SHARE; this amounts to identifying the difference in the amount of change occurring at Sacramento and at the other ALCs, taken as a whole.

ORGANIZATIONAL FLEXIBILITY AND QUALITY OF WORK LIFE: ATTITUDES TOWARD WORK

We will begin by reviewing changes in attitudes toward the work environment through the second year of the demonstration. In distinction to the results at the end of year one, which provided only limited evidence of improvement, a broad series of responses indicates that perceptions of overall working conditions had improved significantly by the end of year two. Satisfaction with supervision and co-worker interactions, overall work satisfaction (the meaningfulness of the job), and other work environment perceptions (trust in management, control of work, training opportunities, organizational involvement) improved significantly at Sacramento by year two as compared with the other ALCs, where little systematic change occurred during the two-year period. In contrast, and consistent with the year-one results, satisfaction with pay and, particularly, with the connection between job performance and compensation or advancement worsened significantly as compared to baseline. Also as true for year one, further analysis indicates that the pay and advancement concerns may have depressed nonpay-related attitudes such as those concerning the three areas mentioned previously. The implication is that dissatisfaction with pay and advancement under the job series consolidation and revised base pay determination innovations must be addressed before we can be certain that improvement in nonpay areas has been observed fully.

In addition to their relation to quality of work life, attitude changes can be addressed in terms of their consistency with the goal of increasing organizational flexibility under PACER SHARE. In contrast to year one, when changes were limited, year-two attitude changes generally supported this goal. For example, perceived staffing flexi-

bility, training opportunities, job competition fairness, supervisory grading criteria fairness, gainsharing of organizational cost savings, and Personnel Office helpfulness increased. Other perceptions showed no change relative to the comparison ALCs: blue-collar versus white-collar pay equity, staffing needs, job classification satisfaction, and career opportunities.

Finally, additional attitude questions showed increases in perceived information exchange in accomplishing day-to-day work, usefulness of quality circle participation, and emphasis of team-building concepts in day-to-day operations. These changes are consistent with both better quality of work life and improved work quality. Many of the changes (especially those for team building) were large and highly significant.

ORGANIZATIONAL FLEXIBILITY AND QUALITY OF WORK LIFE: PERSONNEL MEASURES

The results from the automated personnel system provide greater support for PACER SHARE than was true at the end of year one. Our analysis indicates general improvement from baseline levels at Sacramento relative to changes at the other ALCs during the two-year time period. Consistent with both increased organizational flexibility (the provision of greater salary potential through banding and annual pay increases) and quality of work life (resulting from higher pay), average salary growth in DS during the two-year period was greater at Sacramento than at the other ALCs. The change varied by pay band, but wages in the largest bands increased significantly relative to the comparison sites. Among continuing employees, salaries grew at a rate equal to or greater than those for comparable pay bands at the other ALCs. And, there was no evidence of pay inversion between supervisors and nonsupervisors.

These results are noteworthy in showing that most employees fared as well or better financially under job series consolidation and pay banding than did their counterparts at the other ALCs—operating under the traditional system—despite the worsening of pay-related attitudes. In other words, pay dissatisfaction appears to be a matter of perception. Evidence suggests that the cost of living rose more rapidly in the Sacramento area than at the comparison sites, offsetting salary growth; this may have contributed to the worsening of pay satisfaction. The worsening of attitudes concerning the link between job performance and compensation or advancement is more likely tied to the changes in annual salary increases and promotion practices under job series consolidation and pay banding. It also should be

noted that the salary growth was offset by a reduction in the size of the work force. As discussed below, overall labor costs did not increase.

Three other measures of organizational flexibility concerned the number of skills per employee, the percentage of supervisors, and white- to blue-collar crossovers. Consistent with the goals of expanding training and increasing organizational flexibility, the average number of skills grew significantly more at Sacramento during the two-year period; that is, it appears more skill training was provided, amounting to about one more skill for every three workers than at the other ALCs. In contrast, the percentage of supervisors remained unchanged, both overall and within divisions. On one hand, this suggests that the flexibility provided by changes in supervisory grading criteria has not yet been fully utilized (although it must be recognized that changes such as movement of supervisors below the division level could have occurred under the new criteria). On the other, it indicates that the removal of the number and grades of subordinates as criteria for establishing supervisory positions did not result in proliferation of supervisory positions at Sacramento. White- to blue-collar crossover increased at the other ALCs during year two. Despite revised base pay determination procedures—which seek in part to reduce the economic incentive for crossovers—white- to blue-collar crossovers increased comparably at Sacramento.

Finally, two measures of turnover were examined as they bear on quality of work life and hiring practices. It was believed that the percentage of career employees might decrease if senior personnel were unhappy with PACER SHARE. In fact, the results show that the percentage of career employees grew significantly at Sacramento relative to that at the comparison sites during the two-year period. In addition to possible changes in quality of work life, the increase reflects fewer hiring actions taken at Sacramento to fill vacated positions. Also consistent with greater quality of work life, the turnover rate decreased significantly at Sacramento. It thus became similar to that at the other ALCs, rather than maintaining its historically higher rate.

WORK QUALITY

Our analysis of work quality focused on command-directed measures of error rates and reports of discrepancies (RODs) maintained by the Quality Division and measures of timeliness and support maintained by the Management Division. The findings resemble those of year one. Year-two error rates for controlled exceptions, packing process, receiving inspection, tailgate accuracy, location audit program survey,

and physical count of noncontrolled items showed no overall pattern of change from baseline, at which time rates at Sacramento were superior to those at the comparison sites. Similarly, RODs showed no overall pattern of change from baseline, remaining lower at Sacramento. Finally, there was a relative decline in timeliness and support—as assessed by receiving document posting, binning, high-priority requisitions, and denials—relative to the other ALCs. The two largest changes occurred for binning timeliness and requisitions, and are believed by Sacramento to be at least partially attributable to Automated Warehouse System implementation and management emphases (such as F-15 support). Future analyses will attempt to shed additional light on these findings.

COST SAVINGS

With respect to labor cost savings, PACER SHARE has yielded a steady stream of gainshare payments over the last quarters beginning January 1989, following several quarters without gainshares. Indeed, our analysis suggests that had the gainsharing formula included an adjustment for change in output level between baseline and demonstration period, Sacramento's gainshares would have been still higher. In any case, the gainshare payments imply that labor cost has been below its baseline level. Gainshare payments, however, are not an adequate basis for judging whether PACER SHARE has brought a systematic improvement in Sacramento's productivity. For that, we rely on a multivariate model of labor cost as a function of time and output, which we estimate separately for Sacramento and the other ALCs, for both the baseline and demonstration periods. The estimated model forms the basis of a series of hypothesis tests. Of most importance, the tests show that Sacramento's labor cost under PACER SHARE was not statistically different from that prior to PACER SHARE. Even though gainshares were paid, costs fell within the range expected from Sacramento's pre-PACER SHARE performance. Furthermore, we tested Sacramento's cost relative to that of other ALCs, whose behavior reflects what might have been expected for Sacramento had there been no PACER SHARE. We found no statistically significant evidence that Sacramento had reduced its cost relative to that of its peers.

The potential for cost savings remains and could improve as PACER SHARE matures. More workers, for instance, will become trained in multiple skills and therefore qualified for assignment to a wide variety of tasks as they arise. Still, the potential for cost improvement

x

could be affected in the future by factors outside DS control such as Desert Storm, reorganization, and absorption by the Defense Logistics Agency.

ACKNOWLEDGMENTS

Many individuals contributed their knowledge and support to this project. In particular, we wish to thank Carl McRorie, Eva Ugarkovich, and Gerald Tompkins, the current and former Deputy Directors of Distribution at the Sacramento Air Logistics Center. We are also especially grateful to Colene Krum, Daniel Fuchs, James Cortese, and John Gallegos of the PACER SHARE project office.

At Headquarters, Air Force Logistics Command, we want to express our gratitude to the members of the Directorates of Personnel and Distribution who assisted us, and in particular to Gary Kuziinsky and Jess Garcia. Recognition for their invaluable efforts also is due to the Personnel contacts who worked with us to arrange and carry out the second-year surveys at each of the comparison Air Logistics Centers. They are Robert Wolf (Oklahoma City), Lois Albertson (San Antonio), John Bellmon (Ogden), and Marcia Penone (Warner-Robins). Kay Frances Dolan and Brigitte Schay were among those members of the Office of Personnel Management who provided important input.

At RAND, we are grateful to our colleague Susan Hosek for her encouragement and helpful comments. Special acknowledgment goes to Julie Brown, who conducted the second-year surveys at the five ALCs. Lynn Karoly and Lawrence Hanser provided thoughtful reviews of an earlier draft. Mitchell Wade integrated these materials and revised the report. Jeanne Heller edited the manuscript. We also wish to thank Roberta Goldstone, Nora Wolverson, and Helen Rhodes for their help in preparing this manuscript.

CONTENTS

PREFACE	iii
SUMMARY.....	v
ACKNOWLEDGMENTS	xi
FIGURES	xv
TABLES	xvii
Section	
1. INTRODUCTION	1
Rationale	1
Project Goals	3
Demonstration Site and Population	4
Interventions	5
Risks of the Demonstration.....	11
Evaluating the Demonstration	13
2. THE PACER SHARE EVALUATION: METHODS, MEASURES, AND DATA SOURCES	14
Measuring Productivity: Analysis of Cost Savings	20
Measuring Organizational Flexibility and the Quality of Work Life	27
Measuring Quality and Timeliness of Work	42
Presentation of Results	45
3. ORGANIZATIONAL FLEXIBILITY AND QUALITY OF WORK LIFE: ATTITUDE SURVEY RESULTS	46
Attitude Measures in the Evaluation Model	47
Additional Attitude Measures	59
Assessing the Influence of Attitudes Toward Pay	63
Results for New Measures	65
Summary	67
4. ORGANIZATIONAL FLEXIBILITY AND QUALITY OF WORK LIFE: RESULTS FOR PERSONNEL SYSTEM MEASURES	69
Variables Affected by Job Series Consolidation	70
Variables Affected by Revised Base Pay Determination	71

Variables Affected by Revised Supervisory Grading	
Criteria	76
Variables Affected by a Combination of Interventions ...	78
Summary	85
5. RESULTS FOR WORK QUALITY MEASURES	87
Error Rates and Reports of Discrepancies	87
Timeliness and Support	90
Summary	92
6. ANALYSIS OF COST SAVINGS	93
Relationship to Year-One Cost Analysis	94
Labor Cost Model	95
Hypotheses to Test	96
Regression Results	98
Hypothesis Test Results	103
Gainsharing	106
Summary	114
7. CONCLUSIONS	122
Productivity	122
Organizational Flexibility	123
Quality of Work Life	124
Work Quality and Timeliness	125
A Final Note	126
Appendix	
A. PACER SHARE VS. OTHER OPM DEMONSTRATION PROJECTS	127
B. RESULTS FOR THE SINGLE-INTERCEPT MODEL	129
C. LABOR COST AND OUTPUT DATA BY ALC	137
BIBLIOGRAPHY	143

FIGURES

1.	Labor Cost and Output by ALC, Three-Month Moving Average	99
2.	\ln Labor Cost vs. \ln Output by ALC	102
3.	Unit Cost Trend by ALC, Three-Month Moving Average	108
4.	Sacramento Gainshare Pool (Including Air Force Share): Adjusted vs. Unadjusted	113
5.	Ogden Gainshare Pool (Including Air Force Share): Adjusted vs. Unadjusted	118
6.	San Antonio Gainshare Pool (Including Air Force Share): Adjusted vs. Unadjusted	119
7.	Warner-Robins Gainshare Pool (Including Air Force Share): Adjusted vs. Unadjusted	120
B.1.	Other ALCs' Gainshare Pool (Including Air Force Share): Unadjusted vs. Adjusted via Single-Intercept Model	135

TABLES

1.	Participating Employees by Pay Schedule (Directorate of Distribution, Sacramento Air Logistics Center)	5
2.	Demonstration Pay Schedules and Bands	8
3.	Evaluation Model	16
4.	Data Collection and Analysis Plan	21
5.	Wage Cost Inflator	24
6.	Second-Year Survey Administration Dates and Response Rates	29
7.	OPM Scales: Questions and Alpha Coefficients	31
8.	Additional Variable Groups: Questions and Alpha Coefficients	36
9.	Variables Controlled in the Regression Analysis	39
10.	Measures of Work Accuracy	44
11.	Measures of Receiving Timeliness and Shipping Support	44
12.	Survey Results Relating to Job Series and Grade Consolidation	49
13.	Survey Results Relating to Revised Base Pay Determination	52
14.	Survey Results Relating to Revised Supervisory Grading Criteria and Productivity Gainsharing	54
15.	Survey Results Relating to the Combination of Interventions	56
16.	Regression Results for Additional Attitude Measures Not Referenced in Evaluation Model	60
17.	Regression Results for Attitude Scales Controlling for Perceptions of Pay-Performance Link: Year Two	64
18.	Survey Results by Attitude Area for New Items	66
19.	Changes Associated with Job Series Consolidation: Number of Skills	71
20.	Changes Associated with Revised Base Pay Determination: Salaries by Pay Band	73
21.	Changes Associated with Revised Base Pay Determination: Crossovers	76
22.	Changes Associated with Revised Supervisory Grading Criteria: Supervisors as Percentage of Work Force, by Level	77
23.	Changes Associated with Revised Supervisory Grading Criteria: Percentage of Supervisors by Division	77

24.	Changes Associated with a Combination of Interventions: Percentage of Career Employees by Pay Schedule	79
25.	Changes Associated with a Combination of Interventions: Turnover	80
26.	Changes Associated with a Combination of Interventions: Turnover by Career Category	82
27.	Changes Associated with a Combination of Interventions: Turnover by Pay Schedule	83
28.	Changes Associated with a Combination of Interventions: Turnover by Division	84
29.	Results for Measures of Work Quality: Quality Division Indicators	88
30.	Results for Measures of Work Quality: Management Division Indicators	90
31.	Labor Cost Regressions by ALC	100
32.	Labor Cost Regressions: Sacramento vs. Comparison Group	103
33.	Hypothesis Test Results Using Warner-Robins Intercept	104
34.	Tests for Independence of Unit Cost from Output	110
35.	Sacramento Gainshare Pool Adjustment Computation	111
36.	Ogden Gainshare Pool Adjustment Computation	115
37.	San Antonio Gainshare Pool Adjustment Computation	116
38.	Warner-Robins Gainshare Pool Adjustment Computation	117
39.	Major Survey Areas	125
B.1.	Labor Cost Regressions: Sacramento vs. Comparison Group	130
B.2.	Hypothesis Test Results	131
B.3.	Tests for Independence of Unit Cost from Output	133
B.4.	Other ALCs' Gainshare Pool Adjustment Computation	134
B.5.	Gainshare Payments by Sacramento	136
C.1.	Labor Cost Data, \$	138
C.2.	Output Data: Issues and Receipts	140

1. INTRODUCTION

This report evaluates the first two years of the PACER SHARE Productivity and Personnel Management Demonstration.¹ PACER SHARE is a five-year demonstration initiated by the Directorate of Distribution (DS) at the Sacramento Air Logistics Center (ALC) under the authority of Title VI of the Civil Service Reform Act. That title allows the U.S. Office of Personnel Management (OPM) to waive federal civil service regulations on an experimental basis to determine whether alternative procedures improve public personnel management. (Appendix A describes other demonstration projects authorized by OPM.)² After several years of planning, the project was formally initiated in February 1988.

The demonstration is designed to determine whether certain innovations will improve organizational productivity, flexibility, and quality of work life while sustaining the quality and timeliness of work and the capability of mobilizing during emergencies or wartime. If successful, the interventions constituting the project will be considered for wider application in the federal sector. RAND is the external evaluator.

This section provides the background on PACER SHARE necessary for understanding the methods and results presented in the rest of the report. The material is largely drawn from OPM's announcement of PACER SHARE in the *Federal Register*³ and provides the justification for the demonstration contained therein. This section and the one on methods largely repeat information given in the PACER SHARE baseline report. Readers familiar with that report may wish to proceed directly to the discussion of results, which begins in Sec. 3.

RATIONALE

Broadly speaking, the demonstration grew out of criticism of the federal civil service system (criticism that its system of classification and compensation, staffing, incentives, and performance appraisal impedes efficiency). The federal job classification system, for example, is

¹For baseline and first-year findings, see R-3753-FMP, 1990, and R-3943-FMP, 1991.

²Appendices B and C are located at the back of this volume. Other appendix citations in this report refer to the companion Note, N-3404-FMP, 1991.

³*Federal Register*, Vol. 52, No. 224, November 20, 1987, pp. 44782-44810.

complex. It divides work into a large number of small pieces. The General Schedule (GS) for white-collar work defines 440 jobs and is further divided into 18 grades, or levels of difficulty. The Federal Wage System (FWS) for blue-collar work defines 330 jobs in 15 grades. The system's emphasis on classification accuracy encourages the design of narrow jobs. Furthermore, managers have little control over the pay rates of their employees, classified as they are within narrow grades with limited room for within-grade increases. This is an especially important problem for white-collar employees, whose pay does not reflect local market conditions. Pay raises are thus often effected by reclassifying jobs. As a result, managers and personnel specialists devote much time to writing the frequently lengthy position descriptions required to justify narrow grade and series distinctions.

The rigid specialization arising from narrow job classification can contribute to the employment of more personnel than may be required. Narrow and restrictive qualifications interfere with a supervisor's ability to assign work to employees as needed. Managers who try to establish broader, generalist jobs are likely to have trouble getting them classified. At the supervisory level, grading criteria (such as number of subordinates supervised) can encourage "empire building" and the creation of additional layers of supervision.

Similar concerns apply to staffing. Paperwork is required when an employee is assigned to different duties, whether the action is permanent or temporary. This documentation consumes time and personnel resources, interfering with other needed actions. Reduction-in-force (RIF) procedures for decreasing the size of the work force are also costly and time-consuming.

The incentive awards system provides limited tools for motivating the entire work force. Awards generally go to only a small number of employees and are not perceived as widely available.

Performance appraisal requires the development of performance plans containing elements and standards for every employee. Performance is then evaluated using five rating levels. Setting and measuring performance at five levels for every job, regardless of complexity, increase paperwork and consume time. Moreover, appraisal does not address measurement of aggregate productivity and work quality, which are more important to the Directorate of Distribution than individual performance.

PROJECT GOALS

The PACER SHARE demonstration addresses these criticisms with a set of five interventions put forward by the Directorate, described below. Overall, the objectives of PACER SHARE are to:

- Increase organizational productivity by improving incentives and training to help employees work more effectively and encourage them to originate ideas on improving efficiency.
- Increase organizational flexibility in making job assignments and dealing with fluctuations in workload.
- Enrich the quality of work life by creating a work environment in which individual and organizational goals are compatible, opportunities for individuals to work on a variety of jobs are realized, and training opportunities are expanded.
- Preserve or improve the quality and timeliness of work through quality circles,⁴ team building, and statistical process control.⁵

Achieving these goals requires the adoption of a new management philosophy that encourages greater involvement of all employees in the problems and challenges faced by their organization. Part of this philosophy entails building a sense of "corporate identity" in every directorate member. This philosophy, adopted by the Japanese in the early 1950s, was more recently set out by Deming (1987).

The demonstration aims to promote corporate identity by involving employees directly in improving their organization's productivity and quality of work life. Productivity (during peacetime or wartime) would be increased by having a more versatile work force, more flexibility in making job assignments, greater ease in dealing with fluctuations in workload, and more latitude for establishing supervisory positions. At the same time, there would be a continuation of effort to improve work quality and timeliness by means of statistical process control and by encouraging worker participation in diagnosing and correcting problems and proposing new solutions.

PACER SHARE is the first OPM-authorized demonstration to be conducted in a unionized environment. In this era of resource scarcity, labor-management cooperation is important if new methods are to be

⁴Quality circles are small groups that convene regularly to discuss work problems and means of improvement.

⁵Statistical process control uses statistical protocols to help identify work processes or areas subject to undesirable variations in quality and to bring such variations under control by correcting problems with the work process.

developed for "doing more with less." The demonstration rests on the hypothesis that most employees want to work effectively, and if given proper incentives and encouraged to participate, employees will come up with more productive ways of doing their work.

DEMONSTRATION SITE AND POPULATION

The Directorate of Distribution at the Sacramento ALC operates under the authority of the Air Force Logistics Command. The directorate consists of warehouses and related facilities for receiving, storing, and shipping materiel in support of U.S. Air Force operations around the world. Such materiel includes spare parts, small arms, uniforms, and food rations. Items are received by the directorate from manufacturers or from Air Force facilities where they are not needed. They are logged in and stored until they are needed by another Air Force facility, when they are packed and shipped. Five other directorates operate at the Sacramento ALC:

- Maintenance repairs and modifies weapon systems, performs non-destructive testing of parts, and manufactures parts;
- Materiel Management determines stock levels of weapon systems, parts, and equipment; decides whether to repair or buy new equipment; and initiates R&D contracts to improve weapon system reliability and performance;
- Contracting and Manufacturing locates sources for needed parts and services and manages procurement actions;
- Communications and Computer Systems operates and maintains mainframe computer resources for the ALC, develops and maintains data systems, and provides programming and systems analysis support;
- Competition Advocacy finds or develops additional sources of supply in the private sector and researches proposed procurement actions for possible overpricing.

At baseline, the DS was staffed by approximately 1800 civilians, who are participating in the demonstration, and 120 military personnel, who are not.⁶

⁶Military personnel are not participating in the demonstration because they are prohibited by law from participating in gainsharing plans (one of the five interventions) and because the remaining interventions concern changes in the civilian personnel system.

A salient feature of this demonstration distinguishing it from previous ones is the involvement of large numbers of both blue- and white-collar and both line and management personnel. The staff is divided evenly between General Schedule and Federal Wage System (see Table 1). Another important feature is the involvement of labor unions in the project. At baseline, about 20 percent of DS employees were represented by a union.⁷ Of those, 87 percent belonged to the American Federation of Government Employees; the remainder were members of the Technical Skills Association or the Engineer and Scientist Association.

Table 1
Participating Employees by Pay Schedule^a
(Directorate of Distribution, Sacramento Air
Logistics Center)

Pay Schedule and Supervisory Status ^b	Percentage of Work Force	Number of Employees
Nonsupervisory GS	44.2	808
Supervisory GS and PMRS	5.7	105
Nonsupervisory FWS	45.8	838
Supervisory FWS	4.3	78
Total	100.0	1829

^aThe figures reflect work force status as of February 1988.

^bGS is General Schedule (white collar); PMRS is Performance Management and Recognition System; FWS is Federal Wage System (blue collar).

INTERVENTIONS

Achieving the project goals requires improvements in organizational flexibility and a shift from individually oriented to organizationally based incentives. Accordingly, five interventions were designed:

- Job series consolidation
- Revised base pay determination:
 - Pay banding
 - Eliminating individual annual performance ratings
- Revised supervisory grading criteria

⁷According to a survey of the work force (described below).

- Revised hiring/retention criteria
- Productivity gainsharing

Job Series Consolidation

Under PACER SHARE, DS's 66 job series were consolidated into six broad "processes." A process was defined as "the progressive and interdependent arrangement of events, machines, methods, and resources that produce a good or service." Jobs that contribute to the same goal were assigned to the same process.

The demonstration consolidated 27 blue-collar series into two processes:

- *Material handling process* encompasses physically receiving, examining, packing, moving, storing, and issuing items.
- *Facilities and equipment maintenance* covers physically maintaining and repairing material processing equipment and facilities. This is divided into seven subprocesses (electronic, electrical, metal working, painting, carpentry, industrial-equipment repair, and mobile-equipment repair).

Second, 39 nonsupervisory white-collar series were consolidated into three processes.

- *Distribution process* covers custody and transportation transactions.
- *Management operations process* covers administrative work in providing clerical and general management support.
- *Engineering process* covers all engineering services. This process is divided into two subprocesses (engineering and engineering technical support).

All supervisory positions were consolidated into one process. As a result, supervision is no longer equated with the top grades in each pay schedule. Workers can enter supervision as a distinct career field if they choose to do so, but they do not have to enter supervision to progress to the highest pay levels within their own process.

One intent of job series consolidation was to reduce the time and complexity involved in operating the classification system. Another, broader intent was to enable workers to be utilized on a wider range of tasks, after they had been appropriately trained. Thus, workers

could gain training and experience in a wider variety of work than under the conventional classification system, which offered few opportunities for training or work outside narrowly assigned classifications. Expanding career and multiple-skill training opportunities would enrich the quality of work life. Supervisors would also gain greater capability for prompt reassignment of workers in response to changes in the flow and composition of work. By allowing a worker to be assigned to any job in a process for which he is qualified, the system was intended to improve Directorate responsiveness to work and mission requirements. Job series consolidation would use substantially fewer classifications to reflect differences in type of work and duties.

Revised Base Pay Determination

As a complement to job series consolidation, base pay determination was revised to incorporate pay banding and exclude performance reviews. This simplified pay progression and eliminated performance appraisal as a factor in determining base pay. These revisions have three major objectives: (1) to support the new classification system by giving managers more flexibility in assigning work, (2) to give employees a wider range of potential salary growth without the need for formal promotion procedures, and (3) to decrease reliance on individual incentives in favor of an improved organizational consciousness.

Pay Banding. Pay banding is the combination of sets of adjacent pay grades into bands, resulting in a simplified compensation system. Broadening pay categories was designed to improve responsiveness to mission requirements by making a larger number of potentially qualified employees eligible for required jobs within a category.

Under this intervention, the traditional GS and FWS systems with their constituent grades were replaced by three pay schedules with just four bands each (see Table 2):

1. Demonstration hourly (DH), covering all wage grade (WG) and wage leader (WL) nonsupervisory positions.
2. Demonstration salaried (DW), covering all GS nonsupervisory positions.
3. Demonstration supervisory (DX), covering all supervisory positions (GS, GM, and WS).

Workers converted to the new schedules at their current earnings level. The new system relies on a guaranteed annual percentage in-

Table 2
Demonstration Pay Schedules
and Bands

New Pay Schedule and Band	Current Grades
Demonstration Hourly	
DH-1	WG-1 to WG-3
DH-2	WG-4 to WG-8
DH-3	WG-9 to WG-11
DH-4	WG-12 to WG-15
Demonstration Salaried	
DW-1	GS-1 to GS-4
DW-2	GS-5 to GS-8
DW-3	GS-9 to GS-12
DW-4	GS-13 to GS-14
Demonstration Supervisory ^a	
DX-1	GS-5 to GS-8
DX-2	GS-9 to GS-12
DX-3	GS-13 to GS-14
DX-4	GS-15

^aThis grouping of pay levels is also used for blue-collar supervisors who were converted based on annualizing their current hourly rate of pay.

crease in salary within each pay band. The system was designed for progression through each DH band in 12 years; DW-1 through DW-3, DX-1 and DX-2 in 25 years each; DW-4 and DX-3 in 16 years each; and DX-4 in 11 years. These times were chosen to approximate movement under the conventional system, including within-grade, quality step, and merit increases, and promotions. With the exception of the DW-4, DX-3, and DX-4 bands, the percentage of annual increase was intended to be higher during the first half of the applicable period.

The demonstration pay schedules are adjusted when a general increase changes the GS. The demonstration hourly schedule can also be adjusted according to Sacramento-area wage survey results.

As is true for the conventional system, the pay ranges for the bands overlap, so that a new employee may earn less than a senior employee in a lower band. In addition to within-band increases, employees may earn salary increases by promotion to open positions in a higher band.

Eliminating Individual Annual Performance Ratings. Deming (1987) has hypothesized that individual performance appraisal is counterproductive because it "nourishes short-term performance, annihilates long-term planning, builds fear, diminishes teamwork, nourishes rivalry and politics." Under this hypothesis, it is not competition among workers that improves work quality but cooperation, and cooperation is especially important in an organization such as DS where work units are interdependent. Instead of individual appraisal, Deming advocates more careful selection and placement of employees, better training and education, improved leadership and counseling, and statistical process control, which seeks to minimize variations in work quality.

Under PACER SHARE, annual performance appraisals with their performance elements, standards, and achievement ratings are no longer used as a basis for movement within the pay bands. This intervention dispenses with individual ratings, allowing the time and effort entailed in producing them to be allocated elsewhere.

Nonetheless, some individual incentives remain. Employees may still be promoted from band to band (without the time-in-grade requirements of the old system), and they should find their career opportunities enhanced through increased cross-training. Moreover, although individual, as opposed to organizational, incentives are limited under PACER SHARE, it is uncertain whether this represents a meaningful decrease in individual incentives from the previous system. Only a very small percentage of the work force received quality step increases, and, even under the Performance Management and Recognition System, employees may have been rewarded as much in rotation as on the basis of outstanding performance.

Revised Supervisory Grading Criteria

In the conventional system, supervisors' grades traditionally are based in part on the number and grades of the employees supervised.⁸ Under this intervention, supervisors' grades are based on factors that reflect the supervisors' job responsibilities and the difficulty of carrying out those responsibilities. The intervention thus eliminates the need for a specific subordinate structure for each supervisory position, allowing supervisors to be assigned to positions where they

⁸As authorized by the DoD Appropriations Act, the government is implementing new supervisory grading criteria that do not explicitly rely on number and grades of employees supervised. Whether such factors are indeed removed from consideration is yet to be seen.

are most needed. Since salaries are not based on the numbers and grades of subordinates supervised, supervisors are freer to recommend appropriate staffing changes. Specifically, points are assigned to each supervisory job on six factors: workload of organizational unit; position criticality; degree and scope of responsibility delegated; level and purpose of contacts; kind, degree, and character of supervision exercised; and planning horizon. The total number of points accumulated across the factors is used to assign each supervisory position to one of the four bands in the DX schedule.⁹

Revised Hiring/Retention Criteria

The revised hiring/retention criteria are part of a new Demonstration On-Call (DOC) program, replacing the previous on-call hiring authority. New employees are normally hired into the DOC program and are subject to ten days notice for release and three days for recall. DOC employees are eligible for career status after one year, but conversion depends on DS staff needs, and those with the longest tenure are taken first. When workload or budgetary changes require adjusting the size of the work force, managers try to confine the effects to the applicable DOC segment, accounting for veteran preference and seniority. Recall is in the reverse order. In addition, formal reduction-in-force procedures are not required for termination of DOC employees if a RIF is mandated. This should provide considerable time and monetary savings. However, the new on-call program includes a benefits package, in contrast to the previous one.

Productivity Gainsharing

Productivity gainsharing is a system based on total organizational performance in which cost savings generated during the demonstration are shared equally between the Air Force and DS employees. Cost savings equal the difference between what a workload would have cost under the existing system and what it actually cost under the demonstration. Work quality and timeliness must be maintained at acceptable levels, and the "would have" cost is subject to periodic adjustment for such factors as the introduction of cost-saving technology or work methods. (The "would have" cost remains the same for a year if means of "working smarter" are introduced at employee suggestion and for six months if they result from other sources.) Cost savings computations are confined to operations and support costs

⁹For a more complete description of the six factors, see *Federal Register*, Vol. 52, p. 44792.

and exclude capital costs (plant and most equipment). Over 90 percent of operations and support costs are for labor; therefore, most cost savings come from reduced labor costs. That is, cost savings under the gainsharing system are realized only if the same work is performed for fewer labor dollars or more work is performed for the same labor cost. Unless the workload and funding for DS are increased, the major source of cost savings is the ability of the work force to absorb the workload of employees who leave through natural attrition processes.

This system offers an extrinsic incentive to DS employees intended to help them and the Air Force take advantage of the opportunities for greater productivity that should accompany the changes in the personnel system. It similarly should provide greater incentive to participate in DS's quality circles, process action teams, and task forces. These programs contribute to a work-team-based environment, promoting employee participation in identifying and solving organizational problems related to work quality and productivity.¹⁰

The intention is to link organizational performance directly to individual compensation. Gainsharing payments are linked to the performance of the organization as a whole rather than to the performance of divisions or branches. The purpose of organizational-level payments is to compensate for inequity of opportunity to earn gainshares in some divisions or branches (and branches might not set productivity criteria consistent with DS-wide criteria). Directorate-level gainshares also are more in keeping with PACER SHARE's corporate focus. Payments to DS employees are made in equal dollar shares rather than being based on a percentage of salary.

RISKS OF THE DEMONSTRATION

Despite the goals of PACER SHARE and the expected benefits of the interventions, there may be risks in the demonstration. Organizational change involves risk whenever there is uncertainty about how to implement specific changes and the range of their possible outcomes. If there were no uncertainty and the expected outcomes were all positive, the changes would be made immediately, barring some overriding constraint or regulation beyond the organization's control. Analysts as well as proponents of the demonstration must be aware of downside risks, not only to be sure that the evaluation framework accounts for them along with the expected benefits, but

¹⁰Quality circles, begun in 1980, predate PACER SHARE.

also to help formulate hypotheses about why the interventions were, or were not, effective. Downside risk means that the organization may become worse off under the demonstration as a whole (or under particular changes) than it would have been without it.

Negative outcomes could arise for a variety of reasons, including the following:

- Negative feedback created by eliminating performance appraisals. As pay increases will not be tied to individual performance through appraisals, workers' incentives to shirk could increase, leading to lower organizational productivity.
- Inefficient expansion of supervisory positions. As fewer subordinate positions will be needed to justify a supervisory position, the latter could be inefficiently proliferated.
- Higher outflow of workers due to expanded training. Under PACER SHARE, employees will be more broadly trained and thus should have more opportunities to work outside DS. If compensation does not keep pace with offers from alternative employers, workers could leave DS, causing the Directorate to bear the costs of training but not reap its benefits.
- More transfers out of DS because of the desire to earn promotions eliminated by pay banding or higher separation among those whose near-term step increases under the previous system would have exceeded their annual pay adjustments under PACER SHARE.
- Unexpectedly fast wage growth. If the algorithm used to compute annual pay growth results in greater growth than would have occurred without PACER SHARE, costs could increase rather than decrease.

The evaluation of the demonstration is structured to account for these and other negative outcomes that might result and to examine interrelationships among the interventions that might account for difficulties in achieving the project's goals (for example, failure to provide the training needed to take advantage of the opportunities for organizational flexibility provided by series consolidation and pay banding). Although it is necessary to plan the evaluation to account for the possibility of negative outcomes, the demonstration was undertaken with the expectation that its benefits would outweigh any costs.

Risk is inherent not only in the demonstration's outcomes but in the way it is implemented. For example, a key to effective startup lies in

reducing the forces initially impeding cooperation (e.g., reducing threats) while increasing favorable forces (e.g., incentives). This is discussed more fully in OPM's implementation report.¹¹

EVALUATING THE DEMONSTRATION

RAND's evaluation is intended to measure the extent to which the goals and risks of the PACER SHARE demonstration are realized. Section 2 describes in detail the criteria and means employed in assessing the project's outcomes, along with the measures used. Basically, we hypothesize a set of outcomes in the form of an evaluation model. We then compare the outcomes at the Sacramento Air Logistics Center to the values of identical variables before the demonstration and to the changes on these variables at other Air Logistics Centers not subject to the demonstration. Measures of organizational flexibility and quality of work life were developed by RAND (drawing, in many cases, from OPM-defined variables). They are evaluated from survey data collected by RAND (Sec. 3 gives results to date) and personnel data routinely collected by the Air Force (see Sec. 4). Measures of work quality and timeliness (Sec. 5) and cost savings (Sec. 6) also were developed by RAND and evaluated with data gathered from Air Force records. Our conclusions as of the end of demonstration year two are given in Sec. 7.¹² For a demonstration of this magnitude, however, a substantial evaluation period is required before firm conclusions can be drawn to guide future policy.

¹¹Office of Personnel Management, 1989.

¹²Predemonstration (baseline) data are summarized for comparison in Secs. 3 through 6. More detailed baseline findings are documented in R-3753-FMP.

2. THE PACER SHARE EVALUATION: METHODS, MEASURES, AND DATA SOURCES

To measure the effects of the five PACER SHARE interventions, RAND has designed an evaluation that assesses the extent to which PACER SHARE realizes its goals. This design has been worked out in collaboration with the Directorates of Distribution, Personnel, and Accounting and Finance at McClellan Air Force Base and with the Office of Personnel Management. Because the demonstration is being conducted in a natural environment rather than under controlled laboratory conditions, it is quasi-experimental in nature. The evaluation employs a comparison group to help determine the effects of the demonstration. Four other Air Logistics Centers throughout the country perform functions similar to those of the Sacramento ALC and collectively serve as the comparison group; they are not participating in the demonstration but provide the same types of data that are collected at Sacramento. The four ALCs are located at Hill Air Force Base, Ogden, Utah; Kelly Air Force Base, San Antonio, Texas; Robins Air Force Base, Warner-Robins, Georgia; and Tinker Air Force Base, Oklahoma City, Oklahoma.

The evaluation is designed to identify the effects of the interventions by comparing the test site with the comparison sites before and during the demonstration period. In any such demonstration, many factors can change over time, from the scope of the organization's mission to its workload, production technology, factor costs, incentives, and rewards. Therefore, the demonstration should not be viewed as a tightly controlled experiment in which an isolated factor is permitted to vary while others are not. By using baseline (predemonstration) data as well as comparison sites, the evaluation is structured to ask (1) whether quality of work life, organizational flexibility, quality and timeliness of work, and productivity improved at the Sacramento ALC during the demonstration, and (2) whether they did so to a greater extent than expected without the interventions. A comparison of Sacramento's performance during the demonstration with its performance at baseline should tell whether improvement occurred. To judge whether Sacramento's performance improved relative to what was expected, its performance is compared with that of the other ALCs taken as a group. Their combined performance reflects

general, systemwide tendencies and provides a measure of how well Sacramento might have done on average.¹

How comparable are the ALCs? They share, for example, many characteristics, including similar workloads, job standards, and personnel practices. Nevertheless, among the ALCs there are specific differences in factors that affect job performance, the most obvious example being the physical layout of the DSs. Such differences imply that the times allotted for the performance of specific tasks vary across the ALCs, even though the same methods are used in computing the times. There also may be differences in the composition and compensation of the work force among the ALCs that could affect the outcome measures being evaluated.

By and large, the similarities and differences among the ALCs tend to persist through time,² making cross-ALC comparisons meaningful over the course of the demonstration. Furthermore, what change does occur generally is directed by Headquarters, Air Force Logistics Command, so there is a tendency for all ALCs to change in the same way. Moreover, by agreement with the Air Force, no unique policy changes will be applied to Sacramento, nor will Sacramento be exempted from policy changes affecting other ALCs.

The general persistence of characteristics and the tendency for any change to occur systemwide fit comfortably into the analytic paradigm set forth above. Differences among the ALCs at the outset of the demonstration are netted out by comparing outcomes at Sacramento and the comparison group to their own baselines. Effects of systemwide changes should be picked up in trends at the comparison group. Subtracting the latter from the trend at the demonstration site should then yield evidence of the demonstration's effects.

To evaluate the demonstration, it is necessary to identify expected outcomes by intervention, define operational measures of the outcomes, and specify the data sources. As Table 3 indicates, each intervention has expected, measurable effects, as does the combination of interventions. Nonetheless, because the demonstration implements all interventions at the same time and at a single site, the effects of any single intervention cannot be isolated from the others. The ef-

¹In addition, the companion volume (N-3404-FMP) gives data for each ALC. These data allow trends to be detected and pairwise comparisons to be made. Such comparisons could lead to a more informed judgment about the combined ALC comparisons.

²Based on information received from Sacramento and Headquarters, Air Force Logistics Command, as well as on our own data analyses.

Table 3
Evaluation Model

Intervention	Expected Effects	Measures	Data Sources
I. Job series consolidation	A. Simplified job classification process	<ol style="list-style-type: none"> 1. Number of classification actions 2. Classification error rate 3. Number of classification appeals 4. Number and grades of personnel staff serving Distribution 5. Employee perceptions of classification process 	<p>Personnel records, Personnel Office Productivity Analysis (POPA)</p> <p>Personnel records audits POPA POPA</p> <p>Attitude survey</p>
	B. Improved responsiveness to work/mission requirements through increased flexibility in making assignments to meet workload	<ol style="list-style-type: none"> 1. Perceived flexibility by supervisors 2. Skill base of work force 	<p>Attitude survey</p> <p>Work Force Database (WFDB) from personnel computer system</p>
	C. Expanded career and training opportunities/job enrichment	<ol style="list-style-type: none"> 1. Incidence of multiple skills training 2. Intrinsic work satisfaction 3. Satisfaction with career opportunities 	<p>WFDB</p> <p>Attitude survey</p> <p>Attitude survey</p>
	D. Reduced need for promotions	<ol style="list-style-type: none"> 1. Number of promotions 2. Satisfaction with promotions 	<p>WFDB</p> <p>Attitude survey</p>

Table 3—continued

Intervention	Expected Effects	Measures	Data Sources
II. Revised base pay determination (Pay banding and eliminating annual performance ratings)	A. Increased comparability of pay for GS and WG workers	1. GS and WG salaries by experience level 2. Crossovers from GS to WG and vice versa 3. Blue/white collar equity	WFDB WFDB Attitude survey
	B. Increased pay satisfaction	1. Salary increases by experience/classification 2. Extrinsic reward satisfaction 3. Pay satisfaction 4. Perceived equity (internal, external)	WFDB Attitude survey Attitude survey Attitude survey
	C. Possible pay inversion	1. Supervisor vs. nonsupervisor salaries 2. Salaries for current employees vs. new hires	WFDB WFDB
III. Revised supervisory grading criteria	A. Less disincentive for supervisors to reduce staff	1. Supervisors' perceptions of grading criteria 2. Supervisors' willingness to recommend staff reductions	Attitude survey Attitude survey
	B. Increased dependence of pay level on job responsibilities	1. Pay level by responsibility level on new criteria 2. Supervisors' perceptions of pay level determination	WFDB, classification audits Attitude survey
	C. Streamlined organizational structure	1. Percentage of supervisors by level of supervision 2. Percentage of supervisors by division	WFDB WFDB

Table 3—continued

Intervention	Expected Effects	Measures	Data Sources
IV. Revised hiring/ retention criteria	A. Capability to vary size of work force and retain key personnel	1. Correlation of actual (paid) hours with workload 2. Cost of work force reduction (if RIF)	Accounting Directorate (AC) cost savings analysis WFDB, POPA, personnel record audits
V. Productivity gainsharing	A. Link bonus pay with organizational perfor- mance	1. Cost savings and gainshares paid (dollar value) 2. Productivity index: actual hours/workload 3. Perceived link between organizational performance and bonus pay	RAND cost savings analysis, AC cost savings analysis AC data Attitude survey
VI. Combination of interventions	A. Improved productivity	1. Production levels and cost savings 2. Effectiveness of quality measures 3. Supervisors' perceptions of ability to meet workload changes 4. Performance during surge periods and exercises 5. Multiple skill training	RAND and AC analyses of costs and production Attitude survey Attitude survey DS records WFDB
	B. Improved/maintained quality and timeliness	1. Quality and timeliness rates	RAND analysis of quality/timeliness data from Quality and Management Divisions

Table 3—continued

Intervention	Expected Effects	Measures	Data Sources
	C. Improved ability to fill vacancies	1. Number of authorizations vs. assignments 2. Number of applications 3. Acceptance rate	Personnel records POPA POPA
	D. Reduced turnover and retention of key personnel	1. Turnover by organization, pay level, career category 2. Applications for transfer to outside organization 3. Turnover intention 4. Ratio of career to noncareer employees	WFDB POPA Attitude survey WFDB
	E. Improved organizational climate	1. Organizational climate/involvement 2. Grievances/unfair labor practices 3. Organizational influence 4. Union-management relations 5. Group functioning/teamwork 6. Absenteeism/leave rates by type 7. Adverse actions	Attitude survey POPA Attitude survey Attitude survey Attitude survey Accounting records POPA
	F. Increased job satisfaction	1. Job satisfaction 2. Extrinsic reward satisfaction 3. Intrinsic reward satisfaction	Attitude survey Attitude survey Attitude survey
	G. Increased personnel office support	1. Employee perceptions	Attitude survey
	H. Improved supervision	1. Satisfaction with supervision	Attitude survey

fects of the demonstration must be viewed as arising from the set of interventions. These effects can be grouped into four categories corresponding to the broad goals of the demonstration, which are to improve the following:

- Productivity (cost savings)
- Organizational flexibility
- Quality of work life
- Quality and timeliness of work.³

We break the rest of this section into subsections corresponding to each of the demonstration's goals. (For the discussion that follows, we group organizational flexibility and quality of work life together because the same instruments and sources are used to derive measures of achieving those two goals.) Within each subsection, we discuss the data sources (summarized in Table 4) and methodologies employed to determine whether the demonstration is meeting the goal under consideration. We also present results from analyses that aided in the design or validation of the methodological tools. Results of the evaluation produced by the tools themselves are given in Secs. 3 through 6.

MEASURING PRODUCTIVITY: ANALYSIS OF COST SAVINGS

The cost analysis attempts to determine whether productivity is observed to increase under PACER SHARE more rapidly than otherwise expected, where productivity increase is reflected through lower output cost.⁴ A fundamental question is how expected cost should be characterized. The analysis examines expected cost from two per-

³We do not explicitly evaluate one of the demonstration's goals—sustaining or improving mobilization capability during emergencies or wartime. We believe this goal will be achieved if organizational flexibility and productivity improve. Testing the attainment of greater contributions to mobilization would require an exercise, which could be conducted at a later date if the Air Force so desires.

⁴Formally, we are not studying productivity; a true analysis of productivity examines the increased output for a given bundle of inputs while holding the price of those inputs constant. In our case, cost savings might arise either from increased productivity of inputs or from decreased costs (wages). As we will see, however, Sacramento wages appear to be rising relative to wages at the other ALCs. In the analysis below, when we compare Sacramento's cost savings with cost savings at the other ALCs, the fact that Sacramento's wages rose more rapidly means that any cost savings observed will *understate* productivity gains there.

Table 4
Data Collection and Analysis Plan

Area of Analysis	Instrument/ Method/ Database	Data Collector	Collection Schedule	Sample
Changes in productivity	Cost savings analysis (existing Accounting and Finance and Distribution automated databases)	Directorate of Accounting and Finance Directorate of Distribution	Baseline, monthly during demonstration	Available for Distribution at Sacramento Air Logistics Center and comparison sites
Organizational flex- ibility and quality of work life	Attitude survey	RAND	Baseline, annually during demonstration	Distribution employees At Sacramento: all employees At comparison sites: all supervisors, 550 nonsupervisors
	Personnel Office Productivity Analysis	Directorate of Personnel, OPM	Baseline, quarterly during demonstration	All Directorate of Personnel employees serving Distribution Sacramento and comparison sites
	Personnel records (manual record systems pertaining to Distri- bution)	Directorate of Personnel, OPM	Baseline, annually during demonstration	Sacramento and comparison sites
	Work Force Database (existing automated personnel records)	Directorate of Personnel	Baseline, annually during demonstration	Civilian employees of Directorate of Distribution Sacramento and comparison sites
Quality and time- liness of work in Directorate of Distribution	Quality/timeliness analysis (existing automated Distribution data and authorized audits by Distribution)	Quality and Man- agement Divisions in Directorate of Distribution	Baseline, monthly to quarterly during demonstration	Sacramento and comparison sites

spectives. The first is whether the rate of cost growth at Sacramento is slower under PACER SHARE than would have been projected from Sacramento's base period experience. The second concerns Sacramento's cost growth relative to that experienced by the other ALCs. Slower cost growth is consistent with a positive effect of PACER SHARE on productivity, but it is not strong evidence because other changes can occur contemporaneously with PACER SHARE that also affect cost growth. Such changes fall into two categories, system-level changes such as those promulgated by the Air Force Logistics Command, which has oversight for the five ALCs, and changes specific to Sacramento and each other ALC. We *control* for system changes by analyzing the combined behavior of the other ALCs. In particular, using regression analysis, we compare cost growth at the other ALCs before and during PACER SHARE with that occurring at Sacramento, to evaluate Sacramento's performance relative to that expected without the demonstration. Regressions cannot be used, however, to *isolate* ALC-specific changes unrelated to the demonstration. If such changes occur at Sacramento, affect cost, and are contemporaneous with PACER SHARE, they will be intertwined with the effects of PACER SHARE in the cost estimates for Sacramento. Similarly, such changes at other ALCs may affect their cost estimates.

Variables Measured. The cost analysis focuses on *labor cost*, which constitutes over 90 percent of *short-run variable cost* (the remaining costs stem primarily from shop supplies such as wood, staples, packing material, etc.). There are no available data on energy and capital costs, but those costs should vary little over the analysis period. Energy use (heating, lighting) is expected to remain approximately constant at preperiod levels during the course of the demonstration period. Capital costs related to plant and facilities also are expected to change little because the same buildings and layout are expected to be maintained at the ALCs. A major change in equipment—the Automated Warehouse System (AWS)—was introduced at all the ALCs in the years just before PACER SHARE began. The utilization level is expected to be the same across the ALCs once AWS is completely phased in. The phase-in period will differ somewhat across the ALCs, but that should have little effect on our cost savings analysis. *Output* is measured by monthly transactions—issues and receipts of materiel—between DS and off-base customers or other directorates on base. We obtain data on receipts from off base, on-base receipts from maintenance, on-base receipts not from maintenance, issues to off base, on-base issues to maintenance, on-base issues not to maintenance, and on-base issues to disposal. Issues and receipts are associated with various sets of tasks that in

aggregate amount to the workload. For instance, a received package is typically unloaded, unpacked, and inspected; its contents might then be placed in storage on site, issued to maintenance for repair, or perhaps combined with other materiel to be shipped to another destination. Issues may require retrieval from storage, packaging, packing, inspection, and transportation to the point of shipment. Of course, there also are a host of related support activities such as quality and timeliness assessments; inventory control; rewarehousing; maintaining a paper trail for each item received, stored, or issued; audits; and staff training. In addition, employees participate in activities associated with more general initiatives such as team building and quality circles.

We concentrate on issues and receipts because they reflect the mission of the organization. Since DS's business is transshipment, issues and receipts are a valid measure of output. An alternative measure of output would incorporate internal support tasks. Those are used in determining manning authorizations but are rarely used in measuring productivity, because they are not necessarily tied to external demands for services and are thus subject to manipulation. For instance, an ALC could possibly exaggerate its apparent workload by increasing the volume of internal tasks above the minimum necessary to handle its issues and receipts. If Sacramento did so during PACER SHARE, for example, it could give the appearance of producing more output with the same paid hours of work, thereby making PACER SHARE seem effective. Similarly, other ALCs could conceivably do the same thing, which might make them appear more productive relative to Sacramento. In actuality, the multiplication of needless support tasks is indicative of lower productivity.

To ensure that cost savings indicate true productivity gains, we must check to see that quality and timeliness do not decline under PACER SHARE. To accomplish that, we initially considered including quality and timeliness variables in the regressions. But that is not a viable approach because of the way quality and timeliness outcomes are generated. When a quality measure declines, for instance, steps are soon taken to identify the cause and correct it. As a result, the observed mean and variance of quality and timeliness measures tend to follow the standard sought and its level of tolerance. Consequently, instead of the regression approach, we will separately monitor the quality and timeliness indicators. Quality and timeliness indicators are described later.

Data: Sources and Adjustments. We use monthly labor cost and output data from routinely maintained data systems that are compa-

table across all ALCs. The labor cost data—total payroll by month—comes from their workload system (designated D012). (The base period includes monthly observations from October 1984 through December 1987, and the “year-two” data actually cover 30 months of the demonstration period, January 1988 through June 1990.) These data have been adjusted for wage inflation and are stated in constant 1989 dollars, thus avoiding confounding the effects of inflation with other effects. The cost inflator is based on the figures shown in Table 5, taken from Chap. 5 of Air Force Regulation 173-13. The annual inflation rate was assumed to be valid at the midpoint of the fiscal year, and the inflation rates for intervening months were found by interpolation and for end months by extrapolation. For example, the inflation rate for February 1989 is equal to the inflation rate for March 1989 (1.000) plus one-twelfth the difference of the 1989 rate from that of 1988. The wage inflators shown in Table 5 were further adjusted for wage growth due to the introduction of the Federal Employee Retirement System, which led to rapid growth in the wage bill during 1986 and 1987 as the system was phased in.

Two sources of output data are available. One source is the workload system and the other is the financial system (the latter consists of the system designated D033 and the Standard Base Supply System). The workload system ties each issue or receipt to a specified series of transactions related to its processing, which in turn are linked to its labor standards; this system is used in scheduling and manpower planning. The workload system draws its input from relevant financial-system records and from manual entry. The workload output data have two disadvantages: they count transactions rather than counting issues and receipts directly, and they are not auditable. The financial system data avoid these disadvantages; issues and receipts are counted directly and are audited. Moreover, a complete file of output data is now available for this system but not the workload system. For these reasons, we use the financial system data on output.

Table 5
Wage Cost Inflator

Fiscal Year	Inflator
1985	1.202
1986	1.190
1987	1.129
1988	1.035
1989	1.000
1990	.966

Econometric Model

We begin by discussing a simple regression specification where (the natural logarithm (\ln) of labor cost depends on time and (\ln) output level:

$$\ln c_t = a_0 + a_1 t + a_2 \ln x_t + e_t \quad (1)$$

The specification assumes: (1) the labor cost change from one month to the next occurs at a constant rate of a_1 , that is, a_1 is the time trend in labor cost, and (2) labor cost is proportionately related to output, that is, labor cost changes by a_2 percent for a one percent increase in output. The time trend a_1 can be positive or negative depending on whether wages are rising faster than productivity. If productivity were improving and wages were declining, a_1 would be negative. We expect a_2 to be positive but less than one. This is because the demand for labor should increase as workload increases, and so the amount spent on labor should also increase. However, it is typically less costly to vary the work force utilization rate (proportion of time actively engaged in work) and effort rate (output per unit time when actively working) than to add or release workers. As a result, part of the added work needed to handle a bigger workload comes from greater exertion by workers already on the payroll. Thus, labor cost will rise by a smaller percentage than output.⁵

For our empirical work we basically expand the above specification to allow separate coefficients for other ALCs during the base period, other ALCs during the demonstration period, Sacramento during the base period, and Sacramento during the demonstration period. This kind of flexibility is essential to testing our cost hypotheses (it is also sensible in view of changes that might occur under PACER SHARE). First, PACER SHARE could increase the rate of productivity improvement, implying a lower time trend coefficient (a_1) for Sacramento during the demonstration than in the base period. Second, the change in supervisory grading criteria as well as the use of Demonstration On-Call employees could allow Sacramento to maintain a smaller work force, which would be reflected in a lower intercept (a_0) in the demonstration period. Third, job series consolidation, revised base pay determination, and increasingly pervasive training

⁵Two other variables normally would appear in this model: the price (or amount) of capital and the real wage rate of labor (i.e., adjusted for inflation). We do not have data on these variables apart from an overall wage inflator, which we used to adjust labor cost but which is not ALC-specific. However, their absence will have little effect on empirical results because in the short term they change little.

in multiple skills (as discussed in the previous section) could increase the work force capability to respond to workload fluctuations. This would tend to make the workload coefficient (a_2) smaller. That is, if a given work force can handle a wider variety of tasks, and managers have the authority to assign workers promptly to those tasks then there should be less variation in work force size, hence labor cost, as output varies. Possibly counteracting this effect, Sacramento could make greater use of its DOCs, adding and subtracting them as needed, which would make labor cost more responsive to workload. Thus, the workload effect could become larger or smaller than at baseline.

Previous Models

In the year-one cost analysis we specified and estimated two cost models. One related *unit* labor cost (labor cost divided by output) to an intercept and time trend only. The other model appeared similar to the *total* labor cost equation (Eq. (1))—cost is a function of time *and* output; however, it employed a “*spline*” specification for the time variable. *Under the spline, the time trend line in the demonstration period is forced to begin at the end point of the baseline time trend line.* The time spline allowed us to drop the demonstration period intercept and estimate fewer coefficients with our limited data.

The greater quantity of data available for the present analysis enabled us to test the adequacy of the previous models. These tests found the *total* labor cost model—including terms for both time and output—superior to the *unit* labor cost model (time only). We discovered that the unit labor cost model should include an output variable, which also should interact with the time trend. In other words, unit cost is not independent of output, as the earlier model assumed. When the unit cost model is expanded to include output and a time trend-output interaction it performs much better, but still not as well as the total labor cost model described above. For this reason we have dropped the unit cost model from our analysis.

The previous total labor cost model fared better in the specification tests. The tests pointed to the desirability of relaxing the time trend constraint by eliminating the spline—as we have now done in the total cost model described above—yet the improvement in fit from this change is minor.

The review of previous specifications gave no reason to modify the year-one cost analysis conclusion that PACER SHARE had not then achieved statistically significant cost savings.

MEASURING ORGANIZATIONAL FLEXIBILITY AND THE QUALITY OF WORK LIFE

Organizational flexibility and quality of work life are both measured using survey data and data from computerized files of the Directorate of Personnel. In concert with the Office of Personnel Management, RAND developed an extensive survey of attitudes in the workplace. The survey covers a broad range of quality of work life issues, such as job satisfaction, pay satisfaction, organizational involvement, motivation, and supervision. There also are questions concerning organizational flexibility. For example, supervisors are asked about their perceptions of the job classification process, freedom to make assignments to meet the workload, ability to meet changes in workload, and criteria used for establishing supervisory grades. The survey includes numerous OPM core items previously tested for their reliability and validity that are meant to provide comparisons with other demonstrations as well as a variety of questions specifically tailored for PACER SHARE. Most of the items consist of brief statements followed by a five-point Likert scale indicating level of agreement with the items.⁶ The survey was administered before project implementation and is being administered annually to DS employees at the Sacramento ALC and the comparison sites.

Changes in the quality of work life also are measured with nonsurvey data derived from information contained in the records and computerized databases of the Directorate of Personnel. The measures include separations and migrations (internal transfers), among others. These data were collected for 1987 to establish a baseline and are being collected annually to assess the effects of PACER SHARE.

Organizational flexibility also is assessed using personnel measures. These measures in the automated personnel database system include factors such as the skill base of the work force, supervisory levels, and pay-related measures. In future years, some measures of flexibility are to be measured through a special survey analysis developed by OPM, namely, the Personnel Office Productivity Analysis. This is a survey of classification actions, number of applications, and other personnel office worker output (measured by quarter) and the time required to generate such outputs (measured over a two-week period each quarter). Special audits of personnel records are to be used for other flexibility measures (classification error rate and the cost of any reduction in force that might be implemented).

⁶See App. A in N-3404-FMP for the full questionnaire.

The analytical framework for assessing changes in measures of organizational flexibility and quality of work life provides the means to determine the statistical significance of three types of effects:

- Differences in organizational flexibility and quality of work life between the Sacramento ALC and the comparison site group prior to the demonstration, that is, the measure's baseline value at Sacramento minus its value for the comparison site group.
- Changes in organizational flexibility and quality of work life within the Sacramento ALC and the comparison group during the demonstration period.
- Differences between the extent of change at Sacramento and at the comparison site group relative to the baseline values for each, that is, change in the measure's value at Sacramento minus change in its value for the comparison group.

For nonsurvey measures, both multivariate regression analyses and tests of the difference in proportions (or means) between the Sacramento ALC and the comparison ALCs are conducted. Survey measures are analyzed using multivariate regression. Many of the individual items in the survey are combined into more broadly defined scales, based both on previous analyses of similar items and the results of factor analyses. The broad scales cover such areas as intrinsic work satisfaction, organizational climate, and adequacy of supervision.

Survey Methods and Measures

Survey Administration. The baseline survey was administered to personnel of the Directorate of Distribution at each of the Air Logistics Centers during the period from late fall 1987 through winter 1988, just before the demonstration started. (See R-3753-FMP for administration and response rate detail.) The second-year survey was administered in March 1990 (see Table 6). The survey sample consisted of all DS employees at the Sacramento ALC and 550 randomly chosen nonsupervisors plus all DS supervisory personnel at each of the four other ALCs (about one-third of the work force). Supervisors were oversampled to strengthen separate analyses of their results, given that they compose only 10 percent of the work force. Overall, we chose sample sizes based on a desire to detect attitude changes of one point on a five-point scale among 10 percent of

Table 6
Second-Year Survey Administration Dates and Response Rates

ALC	Dates Administered	Number of Respondents	Sample Size	Gross Response Rate, %
Sacramento	20-23 Mar 90	1196	1587	75.4
Ogden	27 Mar 90	593	758	78.2
Oklahoma City	15 Mar 90	603	783	77.0
San Antonio	13-14 Mar 90	598	819	73.0
Warner-Robins	29-30 Mar 90	399	772	51.7
Total/average		3389	4719	71.8

the work force with a reasonable degree of statistical precision ($p < .10$).

The baseline questionnaire consisted of 150 multiple choice questions concerning respondents' attitudes toward their work environment, 22 background and demographic questions, and four items for Sacramento employees concerning PACER SHARE. The questions were drawn from a standard list prepared by the OPM for use and comparison in demonstration projects supplemented by specific items developed by RAND (in consultation with DS) for PACER SHARE. Seventeen questions were added to the survey for the first-year and subsequent follow-ups. Most of those dealt with team building and other aspects of workers' sense of participation in DS's mission.

RAND staff administered the survey on site in group sessions, which typically consisted of 60 to 150 personnel. To facilitate candor, respondents were not identified on the questionnaires. (Thus, it will not be possible to track individual respondents through the course of the demonstration.) The RAND staff member began with a short explanation of the purpose of the survey and answered any questions. Respondents then completed the self-administered form, working independently. The average time required to fill out the second-year questionnaire was 30 minutes.

Overall, the gross response rate across the five ALCs was 72 percent (see Table 6), which represented a response rate of 75 percent at Sacramento and 70 percent for the comparison group (i.e., the other ALCs, collectively).⁷ Supervisory and nonsupervisory response rates were 78 and 74 percent, respectively, at Sacramento and 73 percent

⁷Overall response rate at baseline was also 72 percent; the Sacramento rate was 80 percent and the comparison group's, 68 percent.

and 69 percent for the comparison group. An examination of personnel records for the survey dates suggests that up to half of the individuals who did not report for the survey were on annual or sick leave or were otherwise not physically available to report for the survey. The refusal rate among those who did report was very low, amounting to less than one percent at each site.

Scale Construction. Planned and exploratory analyses were performed on the baseline survey data. To begin with, the items constituting each scale identified by OPM before the baseline survey were grouped together (the order of item presentation in the questionnaire had been randomized to minimize the development of response sets) and Cronbach's Alpha Coefficient was computed. The coefficient indicates the extent to which the answers to the items were correlated with each other (i.e., the extent to which the items behaved as a scale in the survey). Next, based on an extensive analysis of the intercorrelations among the survey items and the groupings of items resulting from factor analyses, we modified several of the OPM scales by adding one or two items whose responses were found to be highly related to those of the items originally included in the scale. (Results of the factor analyses are given in App. C of N-3146-FMP.) Item discriminant validity analyses also were performed to see whether items correlated more highly with their own scales than with other scales. The resulting measures formed the final set of "OPM scales" used in the analysis.

Table 7 shows the final "OPM scales" used in the evaluation and the variables (i.e., survey questions, by number) making up each scale. Modified scales are indicated by an alphabetic suffix appended to the scale number (e.g., OPM03B); the added item(s) are italicized. The table also shows the Alpha coefficient obtained for the scale, based on the answers provided by all of the respondents across the five ALCs at baseline. The bracketed Alpha coefficient for the modified scales reflects the Alpha obtained before the inclusion of the added item(s).

In some instances, a question's polarity was reversed when it was combined with the other questions defining a scale to generate the mean scale score. For example, under External Equity (OPM04), strong agreement with V070 indicates equity, whereas strong agreement with V022 indicates inequity. Therefore, in averaging each individual's responses to the two questions to come up with a scale average, the Likert categories for V022 were reversed in value. As a result, "strongly disagree" with V022 (inequity) was given the same value as "strongly agree" with V070 (equity). In Table 7, instances of

Table 7
OPM Scales: Questions and Alpha Coefficients

Alpha [Old]	Scale Code	Scale Name and Question
.631	OPM02	CONTROL OVER WORK
	V017	I have control over how I spend my time working.
	V055	I have a great deal of say over what has to be done on my job.
	V071	In DS, authority is clearly delegated.
	V077	I have the authority I need to accomplish my work objectives.
.646 [.519]	OPM03B	EXPECTANCY
	V043	Working hard on my job leads to good job performance.
	V061	Working hard on my job leads to gaining respect from my co-workers.
	V025	<i>Coming up with new ways to do my job leads to good job performance.</i>
.700	OPM04	EXTERNAL EQUITY
		** V022 reversed
	V022	Other employers in this area pay more than the government does for the kind of work I am doing.
	V070	My pay is fair considering what other places in this area pay for the same kind of work.
.757 [.669]	OPM05B	EXTRINSIC REWARD IMPORTANCE
		(V124-V126: How important is each of the following to you?)
	V125	Your chances for getting a promotion?
	V126	The amount of job security you have?
	V124	<i>Retirement benefits?</i>
.850	OPM06	GENERAL SUPERVISION/DIRECTION
	V014	My job duties are clearly defined by my supervisor.
	V019	My supervisor handles the administrative parts of his/her job well.
	V050	My supervisor sets clear goals for me in my present job.
	V074	My supervisor encourages me to help in developing work methods and job procedures.
	V075	My supervisor helps me solve work-related problems.
	V089	On my job I know exactly what is expected of me.
.803	OPM07	GROUP FUNCTIONING
	V004	My unit works well together.
	V011	I have confidence and trust in my co-workers.
	V018	My co-workers encourage each other to give their best effort.
	V100	All in all, I am satisfied with my work unit.
.664	OPM08	INTENT TO TURN OVER
	V085	I often think about quitting.
	V105	During the next year I will probably look for a new job outside DS.

Table 7—continued

Alpha [Old]	Scale Code	Scale Name and Question
.477	OPM09	INTERNAL EQUITY
	V048	Pay differences in DS fairly represent real differences in levels of responsibility and job difficulty.
	V087	My pay is fair considering what people in other directorates are paid.
.877	OPM10	INTRINSIC REWARD IMPORTANCE (V120–V123: How important is each of the following to you?)
	V120	Challenging work responsibilities?
	V121	The chance to accomplish something worthwhile?
	V122	The chance to learn new things on your job?
	V123	Getting a feeling of accomplishment from your job?
.789	OPM11	INTRINSIC WORK SATISFACTION
	V033	My job allows me to achieve personal satisfaction.
	V086	My job is challenging.
	V090	The work I do on my job is meaningful to me.
.837	OPM12	JOB SATISFACTION
	V054	In general, I like working here.
	V058	In general, I am satisfied with my job.
.425	OPM13	LOCKING IN ** V030 reversed
	V030	I could find a job with another employer with about the same pay and benefits as I now have.
	V047	It would be very hard for me to leave my job even if I wanted to.
	V083	I have too much at stake in my job to change jobs now.
.674	OPM14	OPEN GROUP PROCESS ** V057 reversed
	V005	If we have a decision to make, everyone is involved in making it.
	V057	My co-workers are afraid to express their real views.
	V068	In my work unit we tell each other the way we are feeling.
	V094	In my work unit everyone's opinion gets listened to.
.739	OPM15	ORGANIZATIONAL CLIMATE ** V013, V038, V052 reversed
	V013	Employees here feel you can't trust management in this directorate.
	V038	In DS, conflict that exists between work units gets in the way of getting the job done.
	V046	Coordination among work units is good in DS.
	V052	People in DS will do things behind your back.
	V071	In DS, authority is clearly delegated.
	V088	Management is flexible enough to make changes when necessary.

Table 7—continued

Alpha [Old]	Scale Code	Scale Name and Question
.583	OPM16	ORGANIZATIONAL INFLUENCE ** V007, V101 reversed
	V007	When changes are made in DS, the employees usually lose out in the end.
	V101	Employees do not have much opportunity to influence what goes on in DS.
.603	OPM17	PAY AS A MOTIVATOR
	V060	The amount of money I will receive for working harder is enough to make me work harder.
	V079	I will receive more money if I work harder for DS.
.830 [.793]	OPM18D	PAY-PERFORMANCE LINK/PERFORMANCE REWARDS ** V084 reversed
	V002	Regular pay increases here depend on how well a person performs his/her job.
	V024	Promotions here depend on how well a person performs his/her job.
	V027	I will be promoted or given a better job if I perform especially well.
	V082	I will get a larger pay increase if I perform especially well.
	V084	Under the present system financial rewards are seldom related to employee performance.
	V099	I will have better job security if I perform especially well.
	V106	My own hard work will lead to recognition as a good performer.
	V029	<i>My pay is determined by my individual job performance.</i>
	V059	<i>In DS, employees receive equal pay for equal work.</i>
.805	OPM19	PAY SATISFACTION
	V008	Considering my skills and the effort I put into my work, I am satisfied with my pay.
	V081	All in all, I am satisfied with my pay.
.672 [.589]	OPM21B	RECONSIDERATION/REDRESS
	V066	In general, disciplinary actions taken in DS are fair and justified.
	V076	If I were subject to an involuntary personnel action, I believe I would be told about my grievance and appeal rights.
	V067	<i>Employees here take full advantage of their grievance and appeal rights.</i>
.767	OPM23	SATISFACTION WITH PROMOTIONS
	V024	Promotions here depend on how well a person performs his/her job.
	V027	I will be promoted or given a better job if I perform.
.531	OPM25	[SUBSCALE: OTHER WORK GROUPS] ** V038 reversed
	V038	In DS, conflict that exists between work units gets in the way of getting the job done.
	V046	Coordination among work units is good in DS.

Table 7—continued

Alpha [Old]	Scale Code	Scale Name and Question
.659	OPM26	[SUBSCALE: PERSONNEL OFFICE HELPFULNESS] ** V139, V149 reversed
	V137	The personnel office helps me perform my job effectively.
	V139	It takes too long to process the paperwork needed to fill vacancies here.
	V143	The personnel department here provides line management with valuable support services.
	V149	Supervisors in DS feel their ability to manage is restricted by unnecessary personnel rules and regulations.
.681	OPM27	SUPERVISORS: AUTHORITY
	V132	I have enough authority to hire competent people when I need them.
	V141	I have enough authority to determine my employees' pay.
	V146	I have enough authority to promote people.
	V150	I have enough authority to remove people from their jobs if they perform poorly.
.799	OPM30	SUPERVISORS: SATISFACTION ** V128, V139, V149 reversed
	V128	It takes too long to get decisions made in DS.
	V133	Top management generally supports the personnel decisions made by supervisors in DS.
	V137	The personnel office helps me perform my job effectively.
	V139	It takes too long to process the paperwork needed to fill vacancies here.
	V140	Supervisors here cooperate with each other for the attainment of DS's goals.
	V142	In DS, my organization recognizes supervisors who take the time to develop their subordinates' knowledge, skills, and abilities.
	V143	The personnel department here provides line management with valuable support services.
	V149	Supervisors in DS feel their ability to manage is restricted by unnecessary personnel rules and regulations.
.720 [.637]	OPM31B	TRAINING OPPORTUNITIES
	V035	DS gives me adequate training to do my job well.
	V092	I am given the opportunities I want to participate in training programs.
	V091	<i>I am satisfied with the chances I have to learn new things on my job.</i>

NOTE: Scales whose codes end in a letter are modified from the original OPM scales; added items are italicized.

reversed responses are noted with asterisks (e.g., "*** V007, V101 reversed").

Our Alpha coefficients are generally comparable to those found in previous research,⁸ and the analysis generally supports the scale construction proposed by OPM. The noteworthy exceptions are the Internal Equity (OPM09) and Locking In (OPM13) scales, which yielded Alpha coefficients below .5, and, to a lesser extent, the Organizational Influence (OPM16) and Other Work Groups (OPM25) scales, which yielded coefficients between .5 and .6. Accordingly, the items composing these four scales were analyzed individually. The anomalous result for the Internal Equity scale probably is attributable to the wording of question 87, which refers to "other directorates" rather than to "DS" as does question 48. The basis of the results for the three other scales is not clear.

Further correlational and factor analyses were performed to define additional scales for survey questions that appeared to assess similar attitudes but had not been grouped together by OPM. The questions included both OPM items and those developed by RAND for PACER SHARE. As can be seen in Table 8, the "Pay Determinants," "Union Satisfaction," "Organizational Involvement," "Satisfaction with Supervision/Work Unit," and "Supervisors' Classification Satisfaction" groupings yielded large Alpha coefficients, supporting the combination of the grouped items. Thus, they were treated as scales in the PACER SHARE evaluation. The remaining groupings yielded much smaller Alpha coefficients, indicating that the responses to the combined items were more independent of each other. Consequently, the items were analyzed individually rather than combined into scales.

Evaluative Analysis. The primary survey evaluation consisted of computing and comparing the responses for each scale or individual item at Sacramento ALC and the comparison sites. For reference purposes, a summary analysis was made to determine the mean response by site for each item and scale. For scales, each participant's response was itself the mean of his or her responses to the component scale items (following any necessary polarity reversals). An individual's scale response was not counted if a response to any of the component items was missing. (For items, scales, and sites, missing response rates ran from 0 to 8 percent; rates of 1 to 3 percent were typical.) Because supervisors were disproportionately represented in

⁸For example, in the evaluation of the OPM demonstration at the Naval Ocean Systems Center.

Table 8
Additional Variable Groups: Questions and Alpha Coefficients

Alpha	Scale Code	Variable Group Name and Question
.877	PAYDETRM	Pay Determinants (How important is each in determining your pay?)
	V114	The quality of your job performance?
	V115	The quality of your work unit's performance?
	V116	The amount of responsibility on your job?
.862	UNIONSAT	Union Satisfaction
	V045	In general, I like the way the union handles things. (How satisfied are you with the efforts your union has made to get each of the following outcomes for its members?)
	V107	More meaningful work for members?
	V108	Fairer job classifications?
	V109	Fairer promotion policies?
	V110	How satisfied are you with the success your union has in bargaining non-wage issues?
.814	ORGINVOL	Organizational Involvement
	V010	What happens to DS is really important to me.
	V016	To help DS, it is necessary that I think of ways to help other sections, branches, or divisions do their jobs.
	V042	It is necessary for DS to minimize costs and maximize performance.
	V044	It is necessary for everyone in DS to help support other directorates such as Maintenance.
	V053	To help DS, it is necessary that I think of ways to help my section do its job.
	V062	I am personally responsible for helping DS improve its performance.
	V072	For DS to do its mission well, it is necessary for me personally to do a good job.
	V073	If I have ideas on how people in DS could improve their work, I should tell them.
	V080	It is necessary for DS to maintain high work quality and timeliness.
	V095	I can save money for DS by working harder or better.
	V097	I have ideas about how I could do a better job for DS.
.867	SUPVNUNT	Satisfaction with Supervision/Work Unit
	V015	My supervisor encourages subordinates to participate in important decisions.
	V021	My supervisor gives me adequate information on how well I am performing.
	V023	My supervisor has strong technical skills.
	V028	My supervisor demands that people give their best effort.
	V031	My supervisor works well with people.
	V034	My supervisor is interested in my opinion on how to improve things in DS.
	V039	My supervisor keeps informed about the way subordinates think and feel about things.

Table 8—continued

Alpha	Scale Code	Variable Group Name and Question
.723	CLASSSAT	Supervisors' Classification Satisfaction ** V145 reversed
	V032	All in all, I am satisfied with the position classification procedures in DS.
	V145	I have to devote too much time to position classification.
	V148	I have enough authority to influence classification decisions.
	V059	In DS, employees receive equal pay for equal work.
	V134	In DS jobs are classified fairly and accurately.
.500		Union-Management Relations ** V003, V098 reversed
	V003	The union and management are hostile toward each other.
	V093	Management and the union are willing to try solutions that haven't been tried before.
	V098	Management is only willing to negotiate about a few specific issues.
.315		Supervisors' Perceptions of Grading Criteria
	V129	My pay is based partly on the performance of the workers I supervise.
	V136	The criteria used to grade supervisory positions in DS are fair.
	V138	My pay level is based partly on the number and grades of the people I supervise.
.532		Supervisors' Willingness to Recommend Staff Reductions
	V130	The work I am responsible for supervising probably could be done with fewer employees.
	V144	The work I am responsible for supervising probably could be done with fewer mid-level supervisors.

the comparison site samples, means were computed separately for supervisors and nonsupervisors.

The main evaluation followed the summary analysis. It consisted of a series of ordinary least-squares (OLS) multivariate regressions on the responses of the individual survey participants. The regression specification—see N-3404-FMP, App. B—permitted responses to each item and scale at Sacramento to be compared with the responses to the same questions across the four other ALCs taken together (unweighted) and distinguished baseline, year-one, and year-two outcomes. Results were pooled for the other ALCs to reduce the effect of regional and idiosyncratic differences among ALCs, and each partici-

pant's response was weighted equally.⁹ We chose this approach because the numbers of individuals representing each ALC are both large and fairly uniform and because we wish to compare the Sacramento results with those for all other DS employees.

Although the DSs at all of the ALCs perform similar missions, differences in staffing and sampling for the survey could affect the survey responses. The regression analysis controlled for supervisory status because only a sample of the nonsupervisors is selected for survey at the comparison sites, yielding a higher concentration of supervisors, whose attitudes differ from those of nonsupervisors.¹⁰ The analysis also controlled for differences in the background and demographic characteristics of the survey respondents at the different ALCs by including variables for tenure at DS, age, sex, education, and ethnicity (see Table 9). This control is necessary because demographic and other background characteristics could have implications for individual attitudes pertaining to economic incentives or organizational culture¹¹ and because those background characteristics vary with site and possibly over time and survey sample. In fact, all but a few of the variables listed in Table 9 showed statistically significant correlations with responses to at least half our items and scales, according to the survey.¹² Variation with site is obvious from Table 9; ethnicity and

⁹As was true at baseline, the overall survey response rate for Warner-Robins was lower than for the other ALCs in the comparison group. To be conservative, however, we again chose to give the same weight to each Warner-Robins respondent as to those at the three other comparison ALCs, rather than giving them extra weight to adjust for their lower response rate. As a practical matter, it may be noted that such a weighting adjustment would result in only a six percentage point increase in the proportion of the comparison group represented by Warner-Robins. Given the similarity of the results across the ALCs, in which differences in mean scale scores are generally less than three-tenths of a point, the adjustment would be trivial, rarely amounting to more than one or two one-hundredths of a point on the five-point scales. Similarly, even if the attitudes of the nonparticipants varied to some extent from the respondents', the cross-ALC similarity, high participation rate, and personnel record information imply that the effect of such a difference on the survey results would be minimal.

¹⁰Average supervisor responses differed significantly from the nonsupervisory averages ($p < .05$) for over 90 percent of the items and scales measured. (See App. B in N-3404-FMP.)

¹¹It can be argued that changes in attitudes attributable to changes in the composition of the work force during the demonstration are, after all, also attributable to the demonstration. We do not dispute that argument here. Our rationale is simply that changes in attitudes among the same or similar individuals are different from changes due to shifts in the demographic composition of the work force, and that the regression analysis allows us to disentangle and assess each of these effects.

¹²The exceptions: number of years under current supervisor, number of years as a federal employee, and "other" ethnicity. Blue-/white-collar status, pay grade, and education (along with supervisory status) exhibited especially high frequencies of significant correlation (over 80 percent).

Table 9
Variables Controlled in the Regression Analysis
(baseline survey sample profile)

Variable	Emp. Status	Sacramento	Okla. City	Ogden	San Antonio	Warner-Robins
Number of years in DS (percent 5 yr or more) ^a	Nonsup.	48	53	45	49	58
	Superv.	76	88	87	69	86
Pay category (percent blue collar)	Nonsup.	48	53	43	51	49
	Superv.	28	42	37	38	36
Pay grade (percent above GS-8 or WG-8)	Nonsup.	18	20	19	19	20
	Superv.	65	62	64	65	59
Number of years as fed- eral employee (percent 10 yr or more) ^b	Nonsup.	53	39	55	40	55
	Superv.	77	78	89	74	91
Type of appointment (percent career)	Nonsup.	74	76	77	71	79
	Superv.	86	85	92	82	82
Time under current immediate supervisor (percent 1 yr or more)	Nonsup.	45	65	43	48	53
	Superv.	47	69	48	51	57
Membership in union (percent yes)	Nonsup.	23	14	15	11	22
	Superv.	6	2	5	2	3

Table 9—continued

Variable	Emp. Status	Sacramento	Okla. City	Ogden	San Antonio	Warner-Robins
Age (percent over 40)	Nonsup.	54	50	42	53	53
	Superv.	73	80	68	78	79
Sex (percent male)	Nonsup.	54	45	48	61	46
	Superv.	60	74	68	75	69
Education level (percent with some college) ^c	Nonsup.	70	51	58	60	37
	Superv.	75	61	71	71	52
Ethnicity (percent minority) ^d	Nonsup.	37	24	14	77	39
	Superv.	28	16	11	71	27

^aFor this variable, as for most of the others, respondents could choose among several response categories: less than 1 yr, 1–3 yr, 3–5 yr, over 5 yr. The nondichotomous categorical variables—pay category and appointment type—were converted to dichotomous variables as shown above for the regression analysis. For clarity of presentation in this table only, the categories for the other variables have also been aggregated into two for each variable (and employee status—supervisory or nonsupervisory). Only one of the two is shown here for each employee status; the value of the complement is, of course, 100 percent minus the value shown. For these other variables, the aggregation is arbitrary, for example, the percent with 5 yr experience is not necessarily more relevant to the demonstration than the percent with 3 yr.

^bData for this variable are for the time of the year-one survey.

^cWhether degreed or not; excludes those with technical training or apprenticeship only.

^dHispanic, black, or "other." In the regression analysis, ethnicity was represented by three dichotomous variables: white Hispanic (yes/no), black (yes/no), other (American Indian, Asian, Pacific Islander) (yes/no).

education level in particular vary widely. Variation with time is possible because different individuals will be surveyed at different points during the demonstration period. Part of that variation stems from the normal ebb and flow of employees; some individuals will leave each site and others will join. Another part stems from variation in sampling; for nonsupervisors at the comparison sites, each survey is administered only to a randomly selected sample, not the entire population. (And because the surveys are filled out anonymously to encourage candor, establishing a longitudinal panel is not possible.) Furthermore, if the demonstration has the desired effects on productivity at Sacramento, we would expect many of the positions vacated by natural attrition to be left unfilled. This is likely to affect the demographic and background characteristics of the remaining work force. Moreover, the persons attracted to those positions that are filled may differ systematically from persons attracted to such positions before the demonstration. The regression specification allows us to compare attitudes across sites and years while accounting for the effects of such differences in work force composition.

Sources for Personnel System Measures

Like the survey measures, the personnel system measures are used to evaluate changes in organizational flexibility and quality of work life. They address such outcomes as:

- Has the skill base of the work force been expanded?
- Are pay opportunities under the demonstration being maintained or improved, particularly for junior-level personnel (while holding the total wage bill constant)? Is pay inversion between supervisors and nonsupervisors being avoided?
- Are crossovers from white-collar to blue-collar positions (and vice-versa) being avoided?
- Is the demonstration bringing about changes in the percentage or distribution of supervisors?
- Is the combination of interventions reducing turnover? Is this more true of some segments of the work force than others? Has the percentage of the career force been maintained?

The analysis uses calendar year 1987 as a baseline, April 1988–March 1989 for year one, and April 1989–March 1990 for year two. It is designed to detect differences between Sacramento and the comparison ALCs, taken together. Results are based on analysis of person-

nel-record information for all DS employees. Each observation (worker's score on a given outcome measure) is weighted equally; that is, the results are not weighted by site. Crossover and turnover results are analyzed by tests for differences in proportions. All other results are based on a series of OLS regression analyses, which include terms to distinguish the period (baseline, year one, year two) and source (Sacramento, other ALC) of the observation. Supporting data and analyses are provided in App. C of N-3404-FMP.

Personnel measures fall into one of three categories, distinguished by their source and reliability: the Work Force Database, individual ALC records, and OPM survey data. Most of the personnel system measures, listed in Tables 3 and 4, come from the WFDB. These data are tabulated from automated records maintained on the civilian work force by the Directorate of Civilian Personnel at Wright-Patterson Air Force Base. These are the most complete and reliable records. They have been maintained for many years, and our own inspections of them gave us no reason to doubt the Air Force's reliability claims. Two measures, identified as "personnel records" in Tables 3 and 4, must be tabulated from records that are maintained at the individual ALCs using special audits. Finally, a third category of measures must be constructed from information collected by the OPM's Personnel Office Productivity Analysis (POPA) survey, which is to be completed quarterly during the demonstration.

Through consultation with personnel system experts at Wright-Patterson and McClellan Air Force Bases, specifications were developed to obtain reliable computerized measures from the WFDB. Obtaining reliable data for the two smaller sets of measures (the personnel record and POPA measures) has proven more difficult. Most of the record information still is being compiled. Moreover, analysis of the preliminary POPA data raised a number of reliability questions. As a result, the POPA data are still being compiled and verified. For these reasons, the results given in Sec. 4 center on the WFDB measures' analyses. Results for the other personnel measures will be reported when the required information becomes available.

MEASURING QUALITY AND TIMELINESS OF WORK

Measures

The quality and timeliness of work are measured using data provided by the Quality (DSQ) and Management (DSM) Divisions of DS. The analysis focuses on variables whose routine measurement has been mandated by the Air Force Logistics Command. This procedure

guarantees that comparable measures cover a broad range of functions, are both quantifiable and routinely evaluated, and are available for all five ALCs.

The measures cover the range of work performed within DS, including supply; preservation, packaging, and packing of materiel; inspection of materiel processing and receiving; transportation; and inventory (see Tables 10 and 11).¹³ They include reports of discrepancies, which reflect errors in receipts from outside DS or in shipments made from DS; measures of timeliness in accomplishing tasks; and indicators of shipping support.

Results for each quality/timeliness indicator are analyzed using multivariate regression. The analysis tests for differences in the proportion of errors (or proportion of actions within applicable standards) at the Sacramento ALC versus the comparison sites and for changes in these differences over time, using monthly observations. The regression specification includes terms to distinguish the period and source of the outcome (as described for the personnel analyses in the previous subsection).

Weighting and Comparison Issues

In the attitude and personnel system analyses discussed earlier, the results for each individual were given equal weight, rather than computing separate means for each of the comparison ALCs and then averaging those means. For the work quality analysis, there were two issues of weighting and comparison to consider. The first dealt with the weight to be given to the observations for each ALC, which, in this case, consist of quality rates reported in a given month. We had to be careful to make sure that if quality improved in a particular work area, the periodicity with which the associated DSQ indicator was assessed was not reduced. If this pattern were shown by the baseline data, then the quality of work for the comparison group would be understated by equal weighting of each observation, because the ALCs with the best quality would have fewer observations.

Second, to allow a sufficient number of monthly observations for meaningful baseline data, the baseline period was defined as 1985 to 1987. The plan to have the baseline cover other years in addition to

¹³Although there were 11 DSQ measures collected command-wide in year one (of which eight had sufficient observations to be analyzed), directed collection was discontinued during year two. We were able to evaluate the six DS measures shown in Table 10 nonetheless, but year-two data were available only for Sacramento.

Table 10
Measures of Work Accuracy

Supply

- BL7: **Controlled Exceptions**—A list of transactions rejected during computer input is checked to see that all such transactions have been processed accurately and in a timely manner.

Preservation, Packaging, and Packing of Materiel

- PL4: **Packing Process**—Before sealing a shipping container, the line item and its container are checked for tagging, quantity, misselection, etc., and the accompanying documentation is checked for accuracy of record.

Materiel Processing and Receiving Inspection

- RL2: **Inspection**—After a receipt for materiel is released for dispatch, the receipt and its accompanying document are checked to see that they accurately report the identity of the materiel, its condition, tagging, etc.
- RL5: **Tailgate Date Accuracy**—When materiel is off-loaded from the carrier, its documentation and associated computer records are checked to see that the off-loading date is recorded accurately.

Inventory

- VL1: **Location Audit Program Survey**—Locator cards, location change notices, and physical location of materiel are compared as a check on the accuracy of this survey's examination of record-location compatibility.
- VL3: **Physical Count of Noncontrolled Items**—The records from the count are checked against materiel locations.

Reports of Discrepancies (RODs) received: reports received of incorrect shipments from DS.

Reports of Discrepancies (RODs) initiated: reports sent out notifying senders of incorrect shipments received into DS.

Table 11
Measures of Receiving Timeliness and Shipping Support

Percentage of items for which receiving documents are posted within one day

Percentage of receipts binned within two days

Percentage of high-priority requisitions (lower is better)

Percentage of denials of issues due to unavailability of items originally believed to be in stock (lower is better)

1987 raised a second consideration: verification that the pattern of results at Sacramento for 1987 relative to the results at other ALCs was similar to the 1985–1986 pattern of results for the two groups.

Both issues pertain to the DSQ data. The number of observations per ALC is considerably less variable for the DSM data, so only the second issue is relevant there.

To investigate these issues, multivariate regression analyses were performed on the DSQ and DSM data for 1985 to 1987.¹⁴ Overall, the analyses support the use of equal weighting for the monthly observations and the combination of the 1987 observations with those for the earlier period.

First, the DSQ data do not show inverse correlation between quality of work and frequency of measurement. Of the 13 indicators assessed, two (RODs) had identical numbers of observations for the comparison ALCs. Among the remaining 11, the (correlational) relationship between the number of observations for the ALC and the quality level for the ALC was evenly split. In six instances ALCs with better quality rates had fewer observations, and in five instances they had more observations.

Second, the pattern of results for the Sacramento ALC in relation to the comparison group did not differ systematically between the 1985–1986 period and 1987. For 11 of the 13 baseline DSQ measures, the Sacramento data show the same relationship to the comparison group data across the two periods.¹⁵ There are six DSM baseline measures. In all six cases, the pattern of results for Sacramento relative to the comparison ALCs is the same across the two time periods.¹⁶

PRESENTATION OF RESULTS

The next four sections present the results of our analyses. Findings on organizational flexibility and quality of work life are discussed in two separate sections: Section 3 is based on the attitude survey results and Sec. 4 on the personnel measure results. Section 5 covers findings on work quality. Section 6 describes the results of our cost savings analysis. Our conclusions are discussed in Sec. 7.

¹⁴Appendix D in N-3146-FMP gives the regression results and annual rates for each measure over the three-year period.

¹⁵In terms of the sign and significance level of the regression coefficients for Sacramento relative to those for the comparison group, as shown in Table D.1 of N-3146-FMP. The exceptions are PL4 and SL4.

¹⁶See Table D.2 of N-3146-FMP.

3. ORGANIZATIONAL FLEXIBILITY AND QUALITY OF WORK LIFE: ATTITUDE SURVEY RESULTS

In the preceding section, we discussed the methods and data we use to evaluate the outcomes of the PACER SHARE Demonstration Project. We now present the results of the second-year evaluation and contrast them with those at baseline (i.e., predemonstration). As described in Sec. 2, outcomes will be evaluated using four types of measures: (1) survey results, (2) personnel system records, (3) work quality indicators, and (4) measures of costs and production. We begin with results from the survey analysis. Here, the baseline period corresponds to the period of administration of the baseline surveys between November 1987 and March 1988; the year-two surveys were given in March 1990.

The survey is an important tool for evaluating the effectiveness of the PACER SHARE interventions in achieving the demonstration's goals of improving the quality of work life and organizational flexibility. The baseline survey demonstrated substantial variation in attitudes toward the work environment, depending on the specific aspects measured. But without question, the primary area of disapproval concerned pay and promotion practices (i.e., extrinsic rewards). Measures of the organizational climate within DS also reflected unfavorable ratings. In contrast, measures of job and intrinsic satisfaction were either generally favorable or included some favorably rated items.

Baseline attitudes toward existing conditions and personnel practices generally were less favorable at Sacramento ALC than in the comparison group. This could reflect a long-standing difference that existed well before PACER SHARE. However, evidence suggests that satisfaction with existing conditions and practices decreased as PACER SHARE was developed and its details and purposes were explained to the work force.¹

The survey analysis for year two is intended to reveal changes in attitudes at Sacramento (relative to the comparison group) toward the quality of work life and organizational flexibility. We found that attitudes toward pay-related attributes have trended primarily down-

¹See R-3753-FMP.

ward at Sacramento (relative to the comparison group). This outcome appears to be attributable to concerns about the way pay and promotion are handled under the revised base pay determination procedures. Attitudes toward nonpay-related variables generally improved. Moreover, when attitudes toward pay are controlled for, attitudes toward other aspects of work life and organizational flexibility show substantial improvement relative to those of the comparison group.

ATTITUDE MEASURES IN THE EVALUATION MODEL

The evaluation model for PACER SHARE was shown in Sec. 2. The model includes numerous attitudinal measures designed to capture changes in attitudes during the demonstration. Analyses compare the extent of such changes at Sacramento with changes at the other ALCs during the same time period. The next four tables specify the particular scales and individual questions analyzed for each instance in which an attitude measure was listed in Table 3. The order of presentation and labeling are the same. For example, for intervention "I," job series and grade consolidation, expected effect "A" refers to a simplified job classification process. Measure "5" for IA consists of employee perceptions of the classification process. Specifically, measure 5 consists of supervisors' responses to scale CLASSSAT (a supervisory scale) and nonsupervisors' responses to questions 32 and 59 (the two questions in CLASSSAT also answered by nonsupervisors).

For each scale and variable in the four tables, several types of results may be seen. The first column of numbers indicates the mean (average) of the survey participants' responses for the attitude measure at Sacramento ALC at baseline.

The second, third, and fourth columns in the four tables represent OLS regression coefficients.² The coefficient in column two expresses the direction and extent of the baseline difference of the Sacramento attitude level from the attitude level of DS employees at the other ALCs, controlling for differences in the demographic composition and experience of DS employees at the different sites. Significant differences between the attitudes of the Sacramento and comparison site DS work forces (i.e., $p < .05$) are indicated by asterisks. This column thus tests the hypothesis that the predemonstration attitude expressed at Sacramento is the same as the attitude expressed at the other ALCs.

²The regression coefficients are taken from App. B of N-3404-FMP, which also discusses the terms in the regression model.

The first two columns give a picture of the attitudes of DS employees at Sacramento and in the comparison group at baseline. Attitude *levels*, however, are not the focus of this evaluation. The goal of the demonstration is to *improve* quality of work life and organizational flexibility (among other things), so our emphasis is on change. Change is taken up in columns three and four.

Column three (in the four tables) indicates the estimated change in the mean score for the scale or question at the comparison sites after the first two years of the demonstration, as assessed by the year-two survey and compared to their mean score at baseline. The hypothesis tested—and the expectation, given nonparticipation in PACER SHARE—is that the attitude expressed in the comparison group in year two is the same as that expressed there at baseline.

Column four shows the estimated second-year change in mean score at Sacramento. The *difference from the change* in mean score for that scale or variable at the other sites is obtained by subtracting column three from column four. This is the key number, for it tests the hypothesis that the change in attitude at Sacramento is the same as the change in attitude in the comparison group, that is, that the demonstration had no effect on the attitude.

For example, for measure I.A.5, scale CLASSSAT assesses supervisors' attitudes toward the job classification process. The results in Table 12 indicate that at Sacramento ALC the mean response to the items in CLASSSAT was 2.56 at baseline. The five-point survey response scales consisted of 1 = strongly disagree, 2 = disagree, 3 = undecided, 4 = agree, 5 = strongly agree. Thus, as can be seen by examining the items in CLASSSAT (see Table 7), a mean response of 2.56 indicates that, on average, Sacramento respondents tended to disagree that the existing classification process was satisfactory.

The second number for I.A.5 in Table 12 is $-.28$. Because site is denoted by a dummy variable that takes the value 1 for Sacramento (and 0 otherwise), the coefficient $-.28$ indicates that the mean response on CLASSSAT at Sacramento at baseline was .28 lower than at the other ALCs, after adjusting for differences in the composition of the work forces. In other words, even if the comparison ALC work force had the same demographic and experience composition as the Sacramento DS work force, we would expect its mean response on CLASSSAT to differ (to equal 2.84, i.e., $2.56 + .28$). The asterisk indi-

Table 12
Survey Results Relating to Job Series and Grade Consolidation

Evaluation Model Measure: Scales and Individual Items		Regression Coefficient			
		Sacramento Baseline Mean Rating	Sacramento Baseline Diff. from Other ALCs	Year 2 Change for Other ALCs	Year 2 Change at Sacramento
I	A Simplified job classification process				
B	Improved responsiveness to work/mission requirements through increased flexibility in making assignments to meet workload				
C	Expanded career and training opportunities/job enrichment				
D	Reduced need for promotions				
A5	EMPLOYEE PERCEPTIONS OF CLASSIFICATION PROCESS				
	CLASSSAT				
	V32 Supervisors: Classification Satisfaction	2.56	-.28*	+.02	+.17
	V59 Satisfaction with classification (nonsupervisors)	2.22	-.28*	+.03	-.02
	Equal pay for equal work (nonsupervisors)	1.94	-.20*	+.01	-.09
B1	PERCEIVED FLEXIBILITY BY SUPERVISORS				
	V131 Staffing flexibility	2.46	-.16	+.04	+.31
C2	INTRINSIC WORK SATISFACTION				
	OPM11 Intrinsic Work Satisfaction	3.02	-.33*	-.05	+.14*
	OPM31B Training Opportunities	2.59	-.40*	-.05	+.18*
C3	SATISFACTION WITH CAREER OPPORTUNITIES				
	V20 Satisfied with opportunities for advancement	1.98	-.26*	-.03	-.02
D2	SATISFACTION WITH PROMOTIONS				
	OPM23 Satisfaction with Promotions	2.18	-.19*	-.05	-.24*
	V102 Competition fair	1.98	-.15*	-.01	+.16*

NOTE: Asterisk in column two or three indicates the coefficient is significant at the $p < .05$ level; in column four, it indicates the difference in the coefficients for columns three and four is significant at $p < .05$.

cates that the attitude difference between Sacramento and the comparison group is statistically significant. This result thus constitutes a rejection of the hypothesis that Sacramento's predemonstration attitude toward the classification process was the same as that of the comparison group.

In column three, we observe the change in people's attitude two years later at the comparison sites. This change was only $+.02$, indicating no significant change (i.e., $2.84 + .02 = 2.86$). That is, we cannot reject the hypothesis that the attitude in the comparison group in year two was the same as at baseline.

We are especially interested in the unique way in which Sacramento attitudes changed *as compared with attitude changes at the other sites*. The change at Sacramento is shown in column four, where we observe that Sacramento showed a gain of $+.17$ at the end of year two. By comparing columns three and four, we see that this represents an *additional* change of $.15$ above the $.02$ at the other sites ($.17 - .02 = .15$). However, the lack of an asterisk for the $.17$ figure indicates that the *difference in the change* ($.15$) was not statistically significant. Thus, we cannot reject the hypothesis that the Sacramento second-year change in attitude from baseline was the same as the amount of change that occurred at the other ALCs. We now turn to the results, by intervention.³

Job Series and Grade Consolidation

Baseline. Across the ALCs, respondents expressed dissatisfaction⁴ with advancement and promotion opportunities and with the existing classification process. Supervisors tended to feel they did not have sufficient flexibility in making job assignments to meet workload changes. Respondents in the comparison group tended to be satisfied with the intrinsic rewards of their jobs, whereas those at the Sacramento ALC were neutral. Sacramento respondents expressed less satisfaction with existing job classification procedures, advancement opportunities, and promotion practices than their counterparts at the other ALCs and expressed less intrinsic work satisfaction (i.e., were less likely to say their jobs were meaningful or challenging or

³Mean response values for each survey item and scale are given for each ALC, for supervisors and nonsupervisors, in App. B of N-3404-FMP.

⁴In this qualitative summary, ratings of about 2.8 or less are taken to be "low," "unfavorable," or indicating "dissatisfied" respondents; ratings of about 3.2 or more are taken to be "high," "favorable," or indicating "satisfied" respondents; ratings between 2.8 and 3.2 are taken as indicative of an "undecided" or "neutral" response.

that they received desired training). Perceived flexibility in making job assignments to meet workload requirements (among supervisors) did not differ significantly between Sacramento and the comparison group.

Year Two. As can be seen in column three of Table 12, at the year-two follow-up there was little change in attitudes at the comparison ALCs.

Column four shows that there were several unique attitude changes at Sacramento relative to those at the other ALCs. Intrinsic work satisfaction (OPM11), perceived training opportunities (OPM31B), and perceived fairness of job competition (V102) increased significantly at Sacramento relative to the comparison sites. In contrast, satisfaction with promotions (OPM23) declined significantly.

Revised Base Pay Determination

Baseline. Across the ALCs, almost all aspects of pay and promotions in IIB2-IIB4 were rated unfavorably (see Table 13). Perceived pay equity for blue- and white-collar jobs, for jobs within DS, and between DS and other employers was lower among Sacramento ALC respondents. Sacramento employees also expressed less satisfaction with pay and promotions. In contrast, they were more likely to believe that if they worked harder they would be compensated for their effort (OPM17). There were no significant differences across ALCs in perceptions of the roles of work quality, responsibility, and length of service in determining pay (PAYDETRM and V117).

Year Two. For the most part, attitudes at the comparison sites did not change much over the two-year period. The exception was that respondents were more likely to agree that present extrinsic rewards (pay and promotions) were not motivating or related to job performance (OPM17, OPM18D, V6). Nonetheless, perceived pay equity between blue- and white-collar workers (V64) and overall pay satisfaction (OPM19) improved.

As can be seen in column four, however, Sacramento's attitudes worsened significantly relative to other ALCs'. Of the 14 measures in Table 13, nine worsened compared with the attitudes at the other ALCs, whereas only one (V102, fairness of job competition) improved. For example, beliefs that better work would lead to commensurately better pay (scale OPM17) declined by .23 (-.31 - -.08) relative to the change at the other ALCs during the first two years. Similarly, Sacramento employees became even less likely than DS employees at

Table 13
Survey Results Relating to Revised Base Pay Determination

Evaluation Model Measure: Scales and Individual Items	Sacramento Baseline Mean Rating	Regression Coefficient		
		Sacramento Baseline Diff. from Other ALCs	Year 2 Change for Other ALCs	Year 2 Change at Sacramento
II A Increased comparability of pay for GS and WG workers				
B Increased pay satisfaction				
A3 BLUE/WHITE COLLAR INEQUITY				
V64 Make more in blue-collar jobs	3.63 ^a	+ .51*	-.07*	-.11
B2, B3 EXTRINSIC REWARD SATISFACTION, PAY SATISFACTION				
OPM17 Pay as a Motivator	2.41	+ .09*	-.08*	-.31*
OPM18D Pay-Performance Link/Performance Rewards	2.27	-.19*	-.06*	-.20*
OPM19 Pay Satisfaction	2.52	-.22*	+.09*	-.04*
OPM23 Satisfaction with Promotions	2.18	-.19*	-.05	-.24*
PAYDETRM Pay Determinants	2.86	-.07	+.03	-.13*
V6 Present rewards not motivating	3.44 ^a	+ .10*	+.20*	+.26
V12 Pay decisions clear	2.76	-.21*	+.07	-.08*
V20 Satisfied with opportunities	1.98	-.26*	-.03	-.02
V102 Competition fair	1.98	-.15*	-.01	+.16*
V117 Tenure determines pay	2.68	-.04	+.07	-.02
B4 PERCEIVED EQUITY (Internal, External)				
OPM04 External Equity	2.62	-.33*	-.02	-.17*
V48 DS pay differences fair	2.49	-.24*	-.03	-.21*
V87 Pay fair vs. other directorates	2.82	-.03	-.01	-.16*

NOTE: Asterisk in column two or three indicates the coefficient is significant at the $p < .05$ level; in column four, it indicates the difference in the coefficients for columns three and four is significant at $p < .05$.

^aHigher rating reflects less desirable outcome.

the other ALCs to say there was a link between performance and rewards or to be satisfied with pay, promotions, or advancement opportunities. Their understanding of pay decisions (V12) also worsened. Based on the overall pattern of survey results and information received from Sacramento, it appears that these changes likely result from concerns about salary advancement and promotions given pay banding and perhaps the elimination of performance appraisals.

Revised Supervisory Grading Criteria

Baseline. Supervisors generally rated grading criteria unfavorably, and felt that their pay tended to be based on the number and grades of the subordinates they supervised more than on their job responsibilities or the quality of their work (V138 and PAYDETRM; see Table 14). Also, they tended to disagree that the work they supervised could be handled with fewer staff. Supervisors' perceptions of the influence of various grading and pay level criteria (V136, V138, V117, PAYDETRM) on their jobs generally did not differ between Sacramento and the comparison ALCs. The exception was that supervisors expressed less overall satisfaction with the grading criteria at Sacramento ALC. Supervisors at the other sites were much less likely than those at Sacramento to say that the work they supervised could be accomplished with fewer subordinates or mid-level supervisors.

Year Two. At the other ALCs, supervisors' attitudes concerning these measures changed during the two-year period. Although the perceived fairness of the grading criteria (V136) declined, the remaining changes were favorable. The perception that pay is based on the number and grades of subordinates decreased, and respondents were more willing to say that the work they supervise could be accomplished with fewer subordinates and mid-level supervisors.

Changes at Sacramento generally were comparable to those at the comparison sites. Attitudes concerning grading criteria in particular, however, showed more positive change than elsewhere. Sacramento supervisors' perception that their pay is based on the number and grades of their subordinates (V138) declined by an additional 1.22 points relative to the overall decline at the other ALCs (-0.12). This perception is consistent with the goals of the intervention—to base supervisory pay on responsibilities rather than on the number of people supervised. Similarly, their perception that supervisory grading criteria are fair (V136) improved by .29 relative to the other ALCs.

Table 14
Survey Results Relating to Revised Supervisory Grading Criteria and Productivity Gainsharing

	Evaluation Model Measure: Scales and Individual Items	Sacramento Baseline Mean Rating	Regression Coefficient		
			Sacramento Baseline Diff. from Other ALCs	Year 2 Change for Other ALCs	Year 2 Change at Sacramento
III:	REVISED SUPERVISORY GRADING CRITERIA				
	A Less disincentive for supervisors to reduce staff				
	B Increased dependence of pay level on job responsibilities				
A1	SUPERVISORS' PERCEPTIONS OF GRADING CRITERIA				
	V136 Supervisory grading fair	2.54	-.36*	-.12*	+.17*
	V138 Pay based on number and grades of subordinates	3.64 ^a	-.09	-.12*	-1.34*
A2	SUPERVISORS' WILLINGNESS TO RECOMMEND STAFF REDUCTIONS				
	V130 Work supervised requires fewer employees	2.47	+.33*	+.15*	+.08
	V144 Work supervised requires fewer mid-level supervisors	2.96	+.57*	+.45*	+.50
B2	SUPERVISORS' PERCEPTIONS OF PAY LEVEL DETERMINATION				
	PAYDETRM Pay Determinants	3.26	-.12	-.09	-.23
	V117 Tenure determines pay	2.50	-.13	-.06	+.08
V:	PRODUCTIVITY GAINSHARING				
	A Link bonus pay with organizational performance				
A3	PERCEIVED LINK BETWEEN ORGANIZATIONAL PERFORMANCE AND BONUS PAY				
	V36 If DS saves money, shared	2.75	+.66*	-.01	+.47*

NOTE: Asterisk in column two or three indicates the coefficient is significant at the $p < .05$ level; in column four, it indicates the difference in the coefficients for columns three and four is significant at $p < .05$.

^aHigher rating reflects less desirable outcome.

Productivity Gainsharing

Baseline. Sacramento respondents generally disagreed that cost savings achieved by DS through their efforts would be shared with them. Even so, employees at Sacramento ALC were much more likely to say that cost savings would be shared than were those at the other ALCs.

Year Two. There was little change in attitudes toward this idea (V36) at the comparison sites during the first two years of the demonstration. Attitudes at Sacramento improved significantly, however, probably from the gainshares paid in the second year. The average rating on this measure rose to 3.22 ($2.75 + .47$), reflecting agreement for the first time with the notion that organizational savings would be shared. There was strong disagreement with this notion at the other sites (a rating of 2.08), where, of course, there was no expectation that gainshares might be paid.

Combination of Interventions

Baseline. Overall, respondents were (1) undecided about the usefulness of quality measures, (2) dissatisfied with staffing flexibility, (3) undecided about their intention to leave DS, (4) dissatisfied with the organizational climate but personally committed to DS, (5) somewhat satisfied with their ability to control their work but dissatisfied with their control over DS, (6) dissatisfied with union-management relations, (7) unfavorable toward the adequacy of work group functioning, (8) satisfied overall with their jobs and their meaningfulness, (9) dissatisfied with pay and promotion practices and undecided about training opportunities, (10) dissatisfied with the help received from the personnel office, and (11) undecided about the adequacy of supervision (see Table 15). Sacramento respondents expressed significantly less satisfaction in almost all these areas.

Year Two. Column three of Table 15 indicates that most attitudes did not change significantly at the comparison sites during the two-year period. Among those that did change for the better, turnover intention tended to decline (V47, V83) and pay satisfaction (OPM19) increased. On the down side, supervisors expressed less overall satisfaction with the supervision system (OPM30), respondents were less likely to say they knew whether their work was satisfactory (V1), perceived union-management hostility (V3) increased, and pay and advancement opportunities were perceived as less motivating or connected to job performance.

Table 15
Survey Results Relating to the Combination of Interventions

Evaluation Model Measure: Scales and Individual Items	Sacramento Baseline Mean Rating	Sacramento Baseline Diff. from Other ALCs	Regression Coefficient	
			Year 2 Change for Other ALCs	Year 2 Change at Sacramento
VI A Improved productivity				
D Reduced turnover				
E Improved organizational climate				
A2 EFFECTIVENESS, VALIDITY OF QUALITY MEASURES				
V78 Quality programs helpful	2.89	-.22*	+.01	-.02
A3 SUPERVISORS' PERCEPTIONS OF ABILITY TO MEET WORKLOAD CHANGES				
V131 Staffing flexibility	2.46	-.16	+.04	+.31
D3 TURNOVER INTENTION				
OPM08 Intent to Turn over	3.00 ^a	+.26*	+.02	-.01
V30 Could find same pay outside	3.08 ^a	+.29*	+.02	+.12
V47 Hard to leave job	3.18	-.09*	+.14*	-.02*
V83 Too much at stake to change jobs	2.96	+.03	+.12*	+.15
E1 ORGANIZATIONAL CLIMATE/INVOLVEMENT				
OPM15 Organizational Climate	2.31	-.32*	+.00	+.05
OPM21B Reconsideration/Redress	2.76	-.19*	+.01	+.08
OPM30 Supervisors: Satisfaction	2.57	-.42*	-.10*	+.06
ORGINVOL Organizational Involvement	3.69	-.11*	+.00	+.08*
V40 Management concerned about me	1.99	-.36*	-.03	+.20*
V56 Tell supervisors how to improve subordinates' work	2.83	-.11*	-.02	+.15*

Table 15—continued

Evaluation Model Measure: Scales and Individual Items		Regression Coefficient			
		Sacramento Baseline Mean Rating	Sacramento Baseline Diff. from Other ALCs	Year 2 Change for Other ALCs	Year 2 Change at Sacramento
VI	E Improved organizational climate				
	F Increased job satisfaction				
E3	ORGANIZATIONAL INFLUENCE				
OPM02	Control Over Work	3.02	-.26*	-.04	+.12*
V7	When changes, employees lose	3.64 ^a	+.34*	+.05	+.09
V101	Employees can't influence DS	3.86 ^a	+.20*	-.05	-.22*
E4	UNION-MANAGEMENT RELATIONS				
UNIONSAT	Union Satisfaction	2.41	-.16*	+.01	-.10*
V3	Union and management hostile	3.02 ^a	-.14*	+.06*	-.15*
V93	Management and union try new solutions	2.60	-.04	-.04	+.03
V98	Management negotiates few issues	3.61 ^a	+.18*	+.04	-.05
E5	GROUP FUNCTIONING/TEAMWORK				
OPM07	Group Functioning	2.98	-.20*	+.00	+.15*
OPM14	Open Group Process	2.61	-.16*	-.00	+.24*
V38	Work unit conflicts	3.81 ^a	+.29*	+.01	-.00
V41	Tell co-worker work harder	2.76	-.04	+.06	+.04
V46	Work unit coordination good	2.42	-.34*	+.04	+.10
F1	JOB SATISFACTION				
OPM12	Job Satisfaction	3.32	-.26*	-.02	+.05

Table 15—continued

Evaluation Model Measure: Scales and Individual Items	Sacramento Baseline Mean Rating	Regression Coefficient		
		Sacramento Baseline Diff. from Other ALCs	Year 2 Change for Other ALCs	Year 2 Change at Sacramento
V1 F Increased job satisfaction				
G Increased Personnel Office support				
H Improved supervision				
F2 EXTRINSIC REWARD SATISFACTION				
OPM17 Pay as a Motivator	2.41	+ .09*	-.08*	-.31*
OPM18D Pay-Performance Link/Performance Rewards	2.27	-.19*	-.06*	-.20*
OPM19 Pay Satisfaction	2.52	-.22*	+.09*	-.04*
OPM23 Satisfaction with Promotions	2.18	-.19*	-.05	-.24*
PAYDETRM Pay Determinants	2.86	-.07	+.03	-.13*
V6 Present rewards not motivating	3.44 ^a	+.10*	+.20*	+.26
V12 Pay decisions clear	2.76	-.21*	+.07	-.08*
V20 Satisfied with advancement opportunities	1.98	-.26*	-.03	-.02
V102 Job competition fair	1.98	-.15*	-.01	+.16*
V103 Satisfied with job security	3.31	-.03	-.05	-.18*
V117 Tenure determines pay	2.68	-.04	+.07	-.01
F3 INTRINSIC REWARD SATISFACTION				
OPM11 Intrinsic Work Satisfaction	3.02	-.33*	-.05	+.14*
OPM31B Training Opportunities	2.59	-.40*	-.05	+.18*
G1 EMPLOYEE PERCEPTIONS				
OPM26 Supervisors: Personnel Office Helpfulness	2.44	-.41*	-.07	+.23*
H1 SATISFACTION WITH SUPERVISION				
OPM06 General Supervision/Direction	2.96	-.29*	-.01	+.18*
SUPVNUNT Satisfaction with Supervision/Work Unit	2.83	-.24*	+.01	+.22*
V1 Know whether work satisfactory	3.81	-.02	-.08*	+.02

NOTE: Asterisk in column two or three indicates the coefficient is significant at the $p < .05$ level; in column four, it indicates the difference in the coefficients for columns three and four is significant at $p < .05$.

^aHigher rating reflects less desirable outcome.

Overall, the pattern of changes at Sacramento (relative to those at the other ALCs) depends on the area of measurement. Attitudes toward pay and promotion worsened at Sacramento relative to the other ALCs, and turnover intention increased on some measures. In contrast, there was considerable evidence of differential improvement in attitudes concerning nonfinancial aspects of the work environment. Perceptions concerning the organizational climate and personal involvement, organizational influence, group functioning, supervision, and Personnel Office helpfulness tended to improve relative to the other ALCs, and intrinsic (nonfinancial) reward satisfaction also increased significantly.

ADDITIONAL ATTITUDE MEASURES

Tables 12–15 include only those scales and questionnaire items pertaining to the evaluation model. Some of the variables we analyzed were not included in the model. We did not hypothesize *a priori* that these variables would be affected by PACER SHARE. We analyzed them nevertheless because they are important indicators of attitudes toward work, and any changes in them that could be associated with the demonstration would provide useful information. The scales, questions, and results for baseline and year two are shown in Table 16.

Baseline

The upper portion of the table shows results for four OPM scales involving extrinsic reward importance, intrinsic reward importance, expectancy, and adequacy of authority among supervisors. The data indicate that at baseline extrinsic and intrinsic rewards were both rated as being very important—indeed, extrinsic reward importance received the highest mean rating of any scale—and that hard work was expected to lead to good job performance. They also indicate that supervisors felt they needed more authority in making decisions concerning their subordinates. In each case, the Sacramento ratings were lower.

The lower portion of the table shows results for various other questions. The results are more mixed. Respondents tended to feel that performance was not related to turnover or to work assignments, new employees were not well qualified, they would take a different job in DS if they could, and they would be unwilling to serve on a union-management committee. They were undecided about the utility of

Table 16
Regression Results for Additional Attitude Measures Not Referenced in Evaluation Model

Scale Code/ Question Number	Scale Name/Question Content	Sacramento Baseline Mean Rating	Regression Coefficient		
			Sacramento Baseline Diff. from Other ALCs	Year 2 Change for Other ALCs	Year 2 Change at Sacramento
OPM05B	Extrinsic Reward Importance	4.20	-.11*	+.01	+.01
OPM10	Intrinsic Reward Importance	4.06	-.07*	-.01	-.03
OPM03B	Expectancy	3.36	-.15*	-.07*	+.06*
OPM27	Supervisors: Authority	2.25	-.35*	-.12*	-.24*
V9	High performers tend to stay with DS	2.57	-.19*	-.00	-.14*
V63	Low performers tend to leave DS	2.21	-.26*	-.00	-.08
V37	I will be demoted or removed from my position if I perform my job poorly	2.69	-.21*	-.00	-.22*
V51	I will be given simpler work or less work if I perform my job poorly	2.63	+.08	+.05	+.00
V119	Please rate the amount of effort you put into work activities during an average work day	4.09	-.07*	-.01	-.00
V65	New employees in DS are well qualified for their jobs	2.28	-.17*	+.07*	+.10
V69	I have all the skills I need in order to do my job	3.52	-.28*	-.00	-.03
V104	I would prefer not to receive an annual performance appraisal from my supervisor	2.95	-.08	+.33*	+.06*
V135	Without performance appraisal it would be more difficult to reward or discipline employees (supervisors only)	2.92	-.23*	-.46*	-.34

Table 16—continued

Scale Code/ Question Number	Scale Name/Question Content	Sacramento Baseline Mean Rating	Regression Coefficient		
			Sacramento Baseline Diff. from Other ALCs	Year 2 Change for Other ALCs	Year 2 Change at Sacramento
V147	The current system enables me to help the people I supervise improve their performance	3.27	-.22*	-.06	+ .10
V26	If I had the chance, I would take a different job within DS	3.57	-.02	+ .05	-.13*
V111- V113	If I took a new job, I would do so to gain: (Mark 3 of 12)				
	More responsibility	.26	+ .00	-.04*	-.05
	Better pay	.77	-.03*	-.02	+ .04*
	More job security	.19	-.02	-.02	+ .08*
	Better supervisors	.16	-.00	-.02	-.05
	More interesting work	.38	+ .07*	-.01	-.06*
	More important program	.07	-.01	-.01	+ .00
	Better working conditions	.19	+ .03	-.02	-.05
	More convenient office hours	.05	+ .00	+ .00	+ .01
	Better promotion opportunities	.62	-.04*	-.03*	-.06
	More congenial colleagues	.04	-.01	-.00	+ .00
	Better geographical location	.04	-.00	-.00	+ .01
	Better benefits	.16	+ .02	+ .01	+ .04
V127	How important to you are your chances for obtaining a "career" position?	4.01	-.26*	-.04	-.04
V118	Would you be willing to serve as a member of a union-management committee? (1=yes, 2=no)	1.63	-.02	+ .00	+ .00

NOTE: Asterisk in column two or three indicates the coefficient is significant at the $p < .05$ level; in column four, it indicates the difference in the coefficients for columns three and four is significant at $p < .05$.

performance appraisals. In contrast, respondents were likely to agree that they worked hard and had the skills they needed. Supervisors tended to feel that the existing system enabled them to improve their subordinates' performance, and there was general agreement that securing a "career" position was important.⁵ Consistent with the discussion of Tables 12-15, the most common reasons for taking a new job were to secure better pay and better promotion opportunities, which were included as one of the three most important reasons by 77 and 62 percent of the respondents, respectively. Getting more interesting work was the next most common reason, but was mentioned by a much smaller percentage of the respondents (38 percent). The remaining reasons were mentioned by still smaller percentages.

Generally, Sacramento ALC respondents were less inclined to agree with the statements, indicating less favorable attitudes toward existing conditions. Sacramento respondents were no more likely to want to change jobs within DS or to be willing to serve on a union-management committee. Also, for the most part they did not have different reasons for potential job turnover. Among 12 reasons assessed, only three differed significantly in the frequency with which they were rated as being among the most important reasons. Sacramento respondents were more likely to say they would take a new job to get more interesting work and less likely to say they would do so for better pay or promotion opportunities.

Year Two

There were some isolated changes in attitudes on these measures at the comparison ALCs during the two-year period. Respondents were less likely to agree that hard work or innovation led to good job performance or co-worker recognition, that they would leave to get more responsibility or better promotion opportunities, or that annual performance appraisals were desirable. They were more likely to see new employees as being qualified. Supervisors were less inclined to agree they had sufficient authority.

Differences in the changes at Sacramento were limited. The expectation that hard work or innovation leads to good performance increased relative to the other ALCs. However, the perception that high performers stay with DS, that poor performance would result in

⁵Securing a career position was significantly more important to those without a career position.

negative consequences, or that supervisors have sufficient authority (among supervisors) declined. Support for performance appraisal did not decline as much as at the other ALCs, and respondents were less likely to say they wanted another job in DS. Respondents were more likely to say they would take a new job to get better pay or job security (among DOCs), but they were less likely to say they would leave to gain more interesting work.

ASSESSING THE INFLUENCE OF ATTITUDES TOWARD PAY

As mentioned in our discussion of Tables 12-15, the pattern of change in responses concerning pay and promotions during the first two years was different at Sacramento than at the other ALCs. These attitudes, which were very unfavorable to begin with, worsened (became significantly more negative) at Sacramento during the first two years of PACER SHARE relative to the comparison sites. We attribute this result, at least in part, to concerns about salary advancement through the PACER SHARE pay bands.

This pattern of responses led us to wonder whether people might be sufficiently upset about the pay areas that there might be a carryover effect on the responses to other types of scales, which, conceptually, are independent of the pay dimensions. Such effects were found after year one. Broad groups of scales that are potentially affected are those classified as pertaining to satisfaction with supervision and co-worker interactions, overall work (intrinsic) satisfaction, and miscellaneous work environment perceptions.⁶ Thus, we reanalyzed the data to control for such an influence and observe the effect, if any, on the results. Specifically, we examined whether controlling for the

⁶To view the overall pattern of attitudes more clearly, we performed a factor analysis on the scales to group scales that were conceptually similar into broader measures of underlying attitudes. These broader, underlying attitudes are called *attitude factors*. The results and rationale for this scale-grouping process into factors are discussed in App. C of N-3257-FMP. At this point, we want to note that our analysis revealed four major attitude factors and their constituent scales (i.e., the scales that contributed the most to a particular factor):

- Satisfaction with supervision and co-worker interactions
- Overall work satisfaction
- General pay satisfaction
- Reward system satisfaction

It would be meaningless to analyze the influence of removing pay-performance linkage perceptions on the scales comprising the factors of general pay satisfaction (third factor above) and reward system satisfaction (fourth factor above), since such scales concern pay. Thus, we analyzed only the two nonpay-related factors shown above and a third group of miscellaneous scales that did not fall clearly onto a single factor.

perceived link between pay and performance (represented by scale OPM18D) in a new series of regression analyses would have an impact on the scalar outcomes shown in Tables 12-15. "Controlling for" these perceptions meant inserting the respondent's score on OPM18D on the right-hand side of the regression equation, which, in effect, removed its effect on the outcome measures. This allowed us to examine the changes in the mean score for a scale independent of the respondents' perceptions of the link between pay and performance.

Table 17 presents the regression coefficients for the estimated change in Sacramento responses during the first two years before and after controlling for OPM18D. The first column of numbers is drawn from column four of Tables 12-15. The second column reflects the results after controlling for responses to OPM18D. Asterisks indicate that Sacramento's change over the two-year period differed significantly from that at the other ALCs.

As can be seen in Table 17, all indicators of satisfaction with supervision and co-worker interactions improved significantly at Sacramento

Table 17
Regression Results for Attitude Scales Controlling for
Perceptions of Pay-Performance Link: Year Two

		Regression Coefficient for Year Two Change at Sacramento	
Scale Code	Measure	Without Control	With Control
SATISFACTION WITH SUPERVISION AND CO-WORKER INTERACTIONS			
OPM06	General supervision/direction	.18*	.30*
OPM07	Group functioning	.15*	.27*
OPM14	Open group process	.24*	.34*
SUPVNUNT	Satisfaction with supervision/work unit	.22*	.34*
OVERALL WORK SATISFACTION			
OPM11	Intrinsic Work Satisfaction	.14*	.25*
OPM12	Job Satisfaction	.05	.18*
OPM08	Intent to Turn Over	-.01	-.12*
MISCELLANEOUS WORK ENVIRONMENT PERCEPTIONS			
OPM15	Organizational Climate	.05	.16*
OPM02	Control over Work	.12*	.21*
OPM21B	Reconsideration/Redress	.08	.19*
OPM31B	Training Opportunities	.18*	.31*
ORGINVOL	Organizational Involvement	.08*	.12*

NOTE: Asterisk indicates the difference in coefficients between Sacramento and the comparison sites is significant at the $p < .05$ level.

relative to the comparison sites. Results in the other two groups also were encouraging. About half of the scales showed significant improvement relative to the other ALCs, and none worsened. The results are even stronger after controlling for perceptions of the pay-performance link. Every scale increased significantly relative to the other ALCs. From this analysis, we infer that nonpay-related attitudes may have been depressed by dissatisfaction over pay. It could be argued that the causality relation runs in the other direction, but attitudes toward pay are generally the least favorable and show more change than the others. We believe that it is more likely that poor, deteriorating attitudes would depress improvement in other areas than that less unfavorable, more stable attitudes would cause poor attitudes to deteriorate.

RESULTS FOR NEW MEASURES

Table 18 gives regression results for 16 new attitude questions added to the survey in year one at the request of the sponsor. The questions can be grouped into four areas: information use/feedback, quality circles, team building, and miscellaneous. The factor analysis underlying this grouping was discussed in N-3257-FMP.

Year One

At the first-year survey point, attitudes in these areas generally were unfavorable at Sacramento. The exception concerned quality circles, and in particular the opportunity to participate in them. With few exceptions, attitudes were significantly less favorable than at the other ALCs, where they tended to be neutral (i.e., in the 3.0 range). Attitudes toward team building could not be assessed at the other ALCs because the concept was implemented at Sacramento alone. As discussed earlier, it is likely that the lower ratings at Sacramento are accounted for by sensitization of the work force to alleged deficiencies in the existing system, which occurred just before the innovations were implemented. As would be expected, the perceived opportunity to participate in quality circles was significantly greater at Sacramento.

Year Two

There was little change in the attitudes assessed by these measures at the other ALCs between years one and two. Only two of 11 changed significantly: respondents were less likely to agree that par-

Table 18
Survey Results by Attitude Area for New Items

Measure	Sacramento Year 1 Mean Rating	Regression Coefficient		
		Sacramento Year 1 Diff. from Other ALCs	Year 2 Change for Other ALCs	Year 2 Change at Sacramento
INFORMATION USE/FEEDBACK				
V228 Receive help needed	3.19	-.23*	-.02	.07
V229 Decisions support DS	3.08	-.32*	-.04	.05
V230 New knowledge used	2.57	-.40*	-.05	.05
V239 Mission ideas shared	2.59	-.19*	.01	.33*
V241 Supervisory ideas shared	2.24	-.24*	.02	.24*
V242 Participative employees hired	2.74	-.26*	-.08*	.04*
V243 Flexibility for supervisory positions	2.68	-.20*	-.03	.03
QUALITY CIRCLES (QCs)				
V231 Can participate in quality circles	3.63	.72*	-.09*	.08*
V232 QCs share ideas, improve work	3.10	.05	-.01	.22*
MISCELLANEOUS ITEMS				
V235 Participative employees promoted	2.90	-.23*	-.01	.01
V237 Supervisors share performance data	2.62	-.17*	.00	.24*
TEAM BUILDING				
V233 Stressed in day-to-day operations	2.67			.49*
V234 Improved relationship with supervisor	2.59			.25*
V236 Supported by division	3.01			.46*
V238 Improved peer relationships	2.71			.20*
V240 Helped communication between sections	2.57			.31*

NOTE: For team building, asterisk indicates coefficient is statistically significant at $p < .05$; for other areas, asterisk in column two or three indicates the coefficient is significant at $p < .05$, or, in column four, that the difference between the coefficients in columns three and four is significant at $p < .05$.

ticipative employees were the ones hired or that they could participate in quality circles. In contrast, most of the measures showed substantial improvement at Sacramento. Team-building measures in particular showed large positive shifts in attitude, generally on the order of one-quarter to one-half point on the five-point scale. About half of the other scales showed significant gains relative to the comparison sites, and none worsened.

SUMMARY

A broad series of responses indicates that perceptions of overall working conditions improved significantly during the first two years of PACER SHARE. Satisfaction with supervision and co-worker interactions, overall work satisfaction (the meaningfulness of the job), and other work environment perceptions (trust in management, control of work, training opportunities, organizational involvement) improved significantly at Sacramento by the end of year two as compared with the other ALCs, where limited systematic change occurred during the two-year period. In contrast, satisfaction with pay and, particularly, with the connection between job performance and compensation or advancement worsened significantly. Further analysis indicates that the pay and advancement concerns may have depressed nonpay-related attitudes such as those concerning the three areas mentioned previously. The implication is that dissatisfaction with pay and advancement under the job series consolidation and revised base pay determination innovations must be addressed to be certain the improvement in nonpay areas is observed fully.

In addition to their relation to the quality of work life, attitude changes can be addressed in terms of their consistency with the goal of increasing organizational flexibility under PACER SHARE. Attitude changes generally supported this goal. For example, perceived staffing flexibility, training opportunities, job competition fairness, supervisory grading criteria fairness, gainsharing of organizational cost savings, and Personnel Office helpfulness increased. Other perceptions showed no change relative to the comparison ALCs: blue-collar versus white-collar pay equity, staffing needs, job classification satisfaction, and career opportunities.

Finally, additional attitude questions showed increases in perceived information exchange in accomplishing day-to-day work, usefulness of quality circle participation, and emphasis of team-building concepts in day-to-day operations. These changes are consistent with both bet-

ter quality of work life and improved work quality. Many of the changes—especially those for team building—were large and highly significant.

4. ORGANIZATIONAL FLEXIBILITY AND QUALITY OF WORK LIFE: RESULTS FOR PERSONNEL SYSTEM MEASURES

To complement the analyses related to the quality of work life and organizational flexibility in Sec. 3, we turn to personnel system measures in this section to provide answers to questions such as the following:

- Has the skill base of the work force been expanded?
- Are pay opportunities under the demonstration being maintained or improved, particularly for junior-level personnel (while holding the total wage bill constant)? Is pay inversion between supervisors and nonsupervisors being avoided?
- Are crossovers from white-collar to blue-collar positions (and vice-versa) being avoided?
- Is the demonstration bringing about changes in the percentage or distribution of supervisors?
- Is the combination of interventions reducing turnover? Is this more true of some segments of the work force than others? Has the percentage of the career force been maintained?

We do not have results for simplicity of job classification or ability to fill vacancies, which are to be drawn from ALC personnel records and OPM's Personnel Office Productivity Analysis. Results for the missing measures will be reported later, when the required information becomes available.

We reiterate that the primary purpose of the analysis is to establish the predemonstration level for each measure at Sacramento and the comparison sites, and to compare the rate of change for the Sacramento ALC during the demonstration with that for the other ALCs (taken together) during the same time period. Differential change will be attributed to the demonstration. The discussion will cover both the baseline levels for the measures (levels for calendar year 1987) and any differences between Sacramento and the comparison ALCs, taken together. The tables that follow also show results for the two-year change at the comparison sites and Sacramento, and indicate the significance of the difference between the change at Sacramento and the pooled comparison sample (with each observation

weighted equally). Results are based on analysis of personnel record information for all DS employees.

As discussed later, most of the results are based on a series of OLS regression analyses performed on the outcome measures. These include predictor variables to distinguish results for Sacramento baseline (CY 1987), year one, and year two, and the comparison group results for year one and for year two from results for the comparison sites at baseline (the "left out" group).¹ Crossover and turnover results represent raw data. Supporting data and analyses for all results in this section are given in App. C of N-3404-FMP.

VARIABLES AFFECTED BY JOB SERIES CONSOLIDATION

Table 19 presents results concerning the level of multiple skill training. The results correspond to measures I.B.2 and I.C.1 in the evaluation model. (See Tables C.10 and C.11 in N-3404-FMP for related information.) Recall that a goal of job series consolidation is to increase the organization's ability to assign workers to the positions where they are required to handle fluctuations in workload without the encumbrance of narrowly defined job descriptions. This flexibility hinges not only on series consolidation, but on the provision of required multiple skill training. Thus, in support of this goal we would anticipate an increase in the average number of skills trained per employee at Sacramento relative to the comparison sites. This expectation leads to the testable hypotheses relevant to the measure in Table 19:

- The average number of skills per employee at Sacramento is the same at baseline as that in the comparison group.
- There was no change in the average number of skills per employee at the comparison sites over the first two years of the demonstration.
- The change in the average number of skills per employee at Sacramento is the same over the first two years of the demonstration as that in the comparison group. (Rejection implies a greater increase in flexibility if Sacramento's change is larger, less flexibility if it is smaller.)

¹There are no controls for background variables because, unlike the survey analysis, results are based on information for every member of the work force at each ALC during each time period, and because the evaluation design accounts for differences among the ALCs that existed prior to the demonstration. Moreover, possible work force composition changes that influence the outcomes discussed in this section, such as the total labor bill, are relevant to those outcomes.

Table 19
Changes Associated with Job Series Consolidation: Number of Skills
(measures I.B.2 and I.C.1 in evaluation model)

Measure	Sacramento Baseline Rate	Regression Coefficient		
		Sacramento Baseline Diff. from Other ALCs	Year 2 Change for Other ALCs	Year 2 Change for Sacramento
Average number of skills	6.5	-0.2*	0.2*	0.5*

NOTE: Asterisk in column two or three indicates the coefficient is significant at the $p < .05$ level; in column four, it indicates the difference in the coefficients for columns three and four is significant at $p < .05$.

Baseline

Table 19 indicates that the average number of skills coded for Sacramento DS employees—whether DS-related or not—was 6.5 at baseline. This was significantly lower than the average at the other ALCs ($6.5 - -.2 = 6.7$). The key question concerns how this pattern changed for *DS-related skills* during the first two years of PACER SHARE.

Year Two

As seen in column three, skill training increased by .2 skills (one skill per five employees) at the other ALCs by the end of year two. This change was statistically significant, that is, the skill base expanded at the other ALCs. The change at Sacramento was .5 skills—one skill per two employees—as shown in column four. This increase was significantly larger than at the comparison sites. Although the baseline results represent all coded skills, the changes for year two occurred among DS employees and thus represent changes in DS-related skills. The results are consistent with the expansion of the skill base at Sacramento during the first two years, relative to the incidence of multiple skill training at the other ALCs.

VARIABLES AFFECTED BY REVISED BASE PAY DETERMINATION

Salaries

We next examine salaries by pay level and compare supervisor and nonsupervisor salaries. We examined salaries by pay band to observe

whether there would be greater salary growth at Sacramento—exclusive of any gainshare payments—than at the other ALCs as a result of this intervention. In general, there are two reasons why such salary growth might occur: (1) pay rates went up, or (2) the composition of the workers in a specific pay band group changed, and hence the wages paid within that group changed. We also compare supervisors' versus nonsupervisors' salaries to investigate possible pay inversion that could result from decoupling the respective pay schedules. The "null" hypotheses that apply to this analysis are thus as follows:

- Changes in pay rates at Sacramento are the same as in the comparison group. (Rejection of the hypothesis due to a significant increase implies an unfavorable effect if the total wage bill goes up and, if it does not, a favorable effect.)
- Supervisory and nonsupervisory pay rates have not grown closer at Sacramento than they have in the comparison group (inversion implies an unfavorable effect).

The results are shown in Table 20 and correspond to measures II.A.1 and II.C.1 in the evaluation model. (See Tables C.1 and C.2 in N-3404-FMP.) The DH4, DW4, and DX4 levels are not shown because of the very small number of persons they represent. Table 20 shows the baseline pay rates (end of calendar year 1987) at Sacramento (column one), their differences from the baseline rates at the other ALCs (column two), and changes in the rates of pay during the first two years for other ALCs and Sacramento (columns three and four). Wages for blue-collar nonsupervisors are shown in dollars per hour. Salaries for white-collar nonsupervisors and for supervisors are shown in thousands of dollars per year. All figures represent nominal dollars—dollars uncorrected for inflation.

Baseline. Looking first at the blue-collar nonsupervisors, we find that the average hourly wage was higher at Sacramento than at the comparison ALCs for each pay level. The reason is that blue-collar wages are set in part according to prevailing local wages, which are high in Sacramento. The results for the white-collar nonsupervisors and for the supervisors show a different pattern. The average annual salary for the DW3 and DX3 bands did not differ significantly between Sacramento and the comparison sites. For the DW2 band, the average baseline salary was significantly lower at Sacramento, whereas it was higher for the DW1 band. Results for the remaining supervisors also were mixed. The mean DX1 salary was significantly lower at Sacramento than for the comparison group, whereas the DX2 salary was higher. Overall, then, the baseline salaries against which

Table 20
Changes Associated with Revised Base Pay Determination:
Salaries by Pay Band^a
(measures II.A.1 and II.C.1 in evaluation model)

Pay Band	Equates to	Sacramento Baseline Rate	Regression Coefficient		
			Sacramento Baseline Diff. from Other ALCs	Year 2 Change for Other ALCs	Year 2 Change at Sacramento
WAGES					
Blue-collar nonsupervisors					
DH1	WG1-3	\$ 9.10/hr	0.89*	0.59*	-0.33*
DH2	WG4-8	11.81	1.60*	0.41*	1.24*
DH3	WG9-11	13.94	1.66*	0.60*	1.06*
SALARIES					
White-collar nonsupervisors					
DW1	GS1-4	\$15.2/yr	0.4*	1.0*	-0.1*
DW2	GS5-8	18.7	-0.3*	1.7*	3.0*
DW3	GS9-12	27.7	-0.0	2.7*	3.2
Supervisors					
DX1	GS5-8	\$22.0/yr	-5.2*	1.8*	3.1
DX2	GS9-12	33.1	1.2*	2.4*	3.3
DX3	GS13-14	47.8	2.4	4.8*	4.0

NOTE Asterisk in column two or three indicates the coefficient is significant at the $p < .05$ level; in column four, it indicates the difference in the coefficients for columns three and four is significant at $p < .05$.

^aDH figures represent dollars per hour. DW and DX figures indicate annual salary (in thousands). FWS supervisors were assigned to DX bands by converting their predemonstration wages to salary equivalents and placing them where equally paid GS workers were placed.

changes under PACER SHARE are judged were higher at Sacramento for blue-collar nonsupervisors, and either higher or lower—depending on the pay band—for white-collar nonsupervisors and for supervisory personnel. White-collar employees at Sacramento in pay bands 1 and 2 earned notably less than their blue-collar counterparts, a disparity that revised base pay determination is intended to reduce as the demonstration proceeds. Finally, the supervisory salaries at Sacramento do not reflect evidence of predemonstration pay inversion: they are higher than the mean salaries for the comparable white-collar nonsupervisory levels (i.e., DX1 vs. DW2 and DX2 vs. DW3).

Year Two. Column three shows the wage and salary changes at the other ALCs during the two-year period. As would be expected based on inflation, pay increased for each band. As mentioned above, these

changes also could result from changes in composition of the work force. Changes in composition are determined by (1) the workers who left and (2) those who were hired. Additional analyses—which examined pay changes for employees present over the entire two-year period and, among those employees, persons remaining in the same pay band throughout—indicate, however, that composition changes do not account for the pay growth; pay grew significantly for employees who worked at DS throughout the two-year period.

Column four indicates the size of pay changes at Sacramento, and the asterisks indicate their statistical significance *relative to the other ALCs* at the end of year two. We see that in about half the cases, the change at Sacramento was significantly different from that in the comparison group. In two cases, DH1 and DW1, pay declined significantly relative to the other ALCs—because of composition changes and, in particular, new hires. Pay grew for employees who continued to work for DS at Sacramento throughout the two-year period. Annual pay grew significantly at Sacramento relative to the other ALCs for the blue-collar nonsupervisor pay bands DH2 and DH3 and for the white-collar nonsupervisor pay band DW2. We attribute the greater rise for the DH2 and DH3 bands primarily to actual pay increases rather than to composition changes. In contrast, the greater change for the DW2 band appears to reflect composition changes: pay for employees classified in this band (or equivalent range of grades) *throughout* the two-year period increased by similar amounts at Sacramento and the comparison sites. (Among *all* continuing employees who *started* in the DW2 band—whether or not they ended there—pay grew to a greater extent at Sacramento.)

The overall conclusion is that there was evidence of greater nominal salary growth at Sacramento during the first two years of the demonstration. Average pay for the bands containing the most employees (DH2 and DW2) rose significantly more at Sacramento; other bands generally changed comparably, and two instances of relative declines appear to result from composition changes. The fact that employees fared as well or better financially, especially at the nonsenior, nonsupervisor levels, is consistent with the goals of PACER SHARE, given that the total wage bill did not increase (as we shall see later). Moreover, there was little evidence of a pay inversion problem between supervisory and nonsupervisory positions. For the most part, Sacramento's supervisory salaries remained higher than those at the comparison ALCs and above those of the comparable pay grades in the white-collar nonsupervisory schedule (e.g., DX2 vs. DW3).

Crossovers

Table 21 examines blue- to white-collar and white- to blue-collar crossovers (i.e., job changes) among nonsupervisory personnel. This corresponds to measure II.A.2 in the evaluation model. (See Table C.11 in N-3404-FMP.) As noted, the comparatively high wages for blue-collar employees at the Sacramento ALC have raised concerns about the possibility of such crossovers. Analyses based on the data in Table 20 suggest that the blue- versus white-collar gap did not close appreciably at Sacramento during the first two years of the demonstration. Formally, our hypothesis is that the change in crossover rates at Sacramento over the demonstration's first two years is no different from the change in the comparison group. Rejection of the hypothesis due to a relative increase at Sacramento implies an unfavorable effect of the demonstration; a decrease would be a favorable outcome.

Baseline. Concerns over crossovers appear to be exaggerated. Crossover rates ranged from near 0 to just over 1 percent. The Sacramento rates did not differ significantly from those of the comparison group for crossovers in either direction. Given the very low crossover rates, this measure will focus on the extent to which the Sacramento rates remain comparable to the others. It is not reasonable to expect a comparative decrease in crossovers at Sacramento unless rates rise throughout the rest of the system.

Year Two. During the first two years of the demonstration, both types of crossovers increased in the comparison group by about one-half of one percentage point. The increase for white- to blue-collar crossovers was statistically significant, but neither change was large in absolute terms. There was no evidence of differential change at Sacramento among the group of original concern—white to blue collar. Crossovers from blue- to white-collar jobs did increase by 2.6 percentage points, a significant difference as compared with the .5 percentage point increase at the other sites. However, this difference is largely explained by a single reclassification action that affected 12 people in the SPAALS (Shipment Planning and Address Labeling System) unit. When the demonstration began, they were converted from white collar to blue. They petitioned OPM to be reclassified as white collar, a change that was approved and accomplished during the reporting period. This reclassification accounted for 1.7 of the 2.6 percentage point crossover total.

Table 21
Changes Associated with Revised Base Pay
Determination: Crossovers
(measure II.A.2 in evaluation model, in percent, non-
supervisors only)

Type of Crossover	Sacramento Baseline Rate	Sacramento Baseline Diff. from Other ALCs	Year 2 Change for Other ALCs	Year 2 Change at Sacramento
Blue collar to white collar (DH to DW)	0.4	-0.6	0.5	2.6*
White collar to blue collar (DW to DH)	0.3	-0.3	0.5*	0.5

NOTE: Asterisk in column two or three indicates the coefficient is significant at the $p < .05$ level; in column four, it indicates the difference in the coefficients for columns three and four is significant at $p < .05$.

VARIABLES AFFECTED BY REVISED SUPERVISORY GRADING CRITERIA

Tables 22 and 23 present results concerning the levels of supervision and percentage of supervisory personnel. The results correspond to measures III.C.1 and III.C.2 in the evaluation model, respectively. (See Tables C.3-C.6 in N-3404-FMP.) Recall that a goal of the revised supervisory grading criteria is to facilitate a streamlined organizational structure in which supervisors can be assigned to the positions where they are required without regard to the number and grades of subordinates supervised. Because of the decoupling of supervisory positions from the number and grades of subordinates supervised, we would anticipate possible changes in two areas—in the distribution of supervisors by level of supervision, and in increased variation in the percentages of supervisors among the various divisions within DS. The percentage of all supervisors in the total work force might also change; the direction of the effect is difficult to anticipate, however, since beneficial gains in supervisory percentage in one segment of the organization could be offset by beneficial reductions in other segments. Testable hypotheses relevant to the measures in Tables 22 and 23 are thus as follows:

- Changes in the distribution of supervisors by supervision level at Sacramento are the same over the first two years of the demonstration as those in the comparison group. (Rejection implies greater flexibility.)

- Changes in the distribution of supervisors by division at Sacramento are the same as those in the comparison group. (Rejection again implies flexibility.)

Table 22 indicates little variation in the percentage of supervisory personnel across the ALCs at baseline. The total percentage of supervisors and the percentage of supervisors at each level did not differ significantly at baseline between Sacramento and the comparison group. In addition, there were no significant changes during the first two years of the demonstration for the ALCs in general or Sacramento in particular. Table 23 indicates that the percentage of

Table 22

**Changes Associated with Revised Supervisory Grading Criteria:
Supervisors as Percentage of Work Force, by Level
(measure III.C.1 in evaluation model)**

Supervision Level	Sacramento Baseline Rate	Regression Coefficient		
		Sacramento Baseline Diff. from Other ALCs	Year 2 Change for Other ALCs	Year 2 Change at Sacramento
1	7.5	-0.2	-0.2	-0.1
2	2.3	-0.2	0.1	0.1
3	0.6	-0.0	-0.1	0.1
Total, 1, 2, or 3	10.4	-0.4	-0.2	0.1

Table 23

**Changes Associated with Revised Supervisory Grading Criteria:
Percentage of Supervisors by Division
(measure III.C.2 in evaluation model)**

Division	Sacramento Baseline Rate	Regression Coefficient		
		Sacramento Baseline Diff. from Other ALCs	Year 2 Change for Other ALCs	Year 2 Change at Sacramento
Material Processing (DSF)	8.9	-0.1	-0.2	-0.9
Management Services (DSM)	10.4	-0.9	0.2	2.1
Supply (DSS)	10.3	-0.5	-0.1	1.7
Transportation Operations (DST)	11.7	-0.9	-0.0	0.7

supervisors within divisions also was comparable across the ALCs. At baseline, percentages of supervisors by division at the Sacramento ALC showed no statistical differences from the percentages in the same divisions for the comparison group. And, there were no significant changes during the first two years of PACER SHARE. Overall, then, the supervisor results provide no evidence of differential change in the allocation of supervisors at Sacramento during the first two years of the demonstration.

VARIABLES AFFECTED BY A COMBINATION OF INTERVENTIONS

Percentage of Career Employees

There are at least three reasons for assessing possible changes in the percentage of career employees during this period. For one, the Demonstration On-Call program will provide greater flexibility in the release and recall of workers and in their conversion to career status, depending on workload demands. Work force adjustments will be made in the noncareer Demonstration On-Call complement whenever possible. Thus, a decline in the workload should not necessitate a reduction in the career force to the same extent as at the comparison sites. Second, to the extent that productivity rises, positions vacated through natural attrition may not be refilled. This too would raise the percentage of the career force relative to the other ALCs. Finally, the opposite trend could occur if negative attitudes toward PACER SHARE increased attrition among senior personnel. Results concerning the percentage of career employees at each of the ALCs are presented in Table 24 by pay schedule. The results correspond to measure VI.D.4 in the evaluation model. (See Tables C.7 and C.8 in N-3404-FMP.) Formally, we are testing the hypothesis that the percentage of career employees did not change differentially at Sacramento relative to the comparison group.

Baseline. The percentage of career employees ranged from 80 to 85 percent for the nonsupervisory schedules to nearly 100 percent for the supervisory schedule. The percentage of career employees at Sacramento, relative to the comparison ALCs, was significantly lower for the nonsupervisory pay schedules. The percentage of career employees among the supervisors did not differ significantly.

Year Two. As can be seen in the third column of Table 24, changes in the percentage of career employees at the other ALCs were mixed. The career percentage declined significantly among blue-collar nonsupervisors, remained similar among white-collar nonsupervisors,

Table 24
Changes Associated with a Combination of Interventions:
Percentage of Career Employees by Pay Schedule
(measure VI.D.4 in evaluation model)

Pay Schedule	Sacramento Baseline Rate	Regression Coefficient		
		Sacramento Baseline Diff. from Other ALCs	Year 2 Change for Other ALCs	Year 2 Change at Sacramento
Blue-collar nonsuper- visors (DH)	77.8	-3.3*	-2.9*	5.0*
White-collar non- supervisors (DW)	81.6	-4.8*	0.7	6.4*
Supervisors (DX)	97.3	-0.5	1.6*	-0.3

NOTE: Asterisk in column two or three indicates the coefficient is significant at the $p < .05$ level; in column four, it indicates the difference in the coefficients for columns three and four is significant at $p < .05$.

and increased among supervisors. Whereas the career percentage among nonsupervisors was level or declined elsewhere, this was not true at Sacramento. The percentage of career employees rose for the DH and DW pay schedules, and the difference between Sacramento and the comparison sites was statistically significant. There was no change in the percentage of career employees among supervisors at Sacramento relative to the comparison sites. On balance, then, the results reflect the fact that senior staff did not disproportionately leave DS at Sacramento as a result of PACER SHARE and that non-career positions vacated through natural attrition were not filled to the extent they were at the other ALCs. (The former point will become clearer in our discussion of turnover, below.) New hires were substantially lower at Sacramento than at the comparison sites during the demonstration period, according to official personnel records. For both blue- and white-collar nonsupervisors, we thus reject the null hypothesis of no differential change in the percentage of the work force composed of career personnel.

Turnover

The next four tables present turnover information. Instances of turnover are distinguished according to whether they reflect separations or internal transfers (migrations) to other directorates at the given base. The results correspond to measure VI.D.1 in the evaluation model. (See Tables C.12-C.15 in N-3404-FMP.) To the extent

that PACER SHARE achieves its goal of improving the quality of work life, we would expect turnover to decrease over time during the demonstration. Such a decrease, however, could be preceded by an initial period of greater turnover, during which time staff members adverse to PACER SHARE leave DS. Formally, we are testing the hypothesis that the change in the turnover rate at Sacramento in the first two years of the demonstration is the same as that in the comparison group. Rejection due to a relative decrease at Sacramento implies a beneficial effect; rejection due to an increase implies a harmful effect. The results in the four tables establish the turnover levels for DS as a whole and for specific subgroups of the work force for which changes in turnover are being assessed. Our null hypotheses for the subgroups are analogous to that for DS as a whole. However, we do not associate rejection with a beneficial or negative effect beyond that established for DS because subgroups showing less turnover than DS as a whole must be balanced by subgroups showing greater turnover than DS as a whole. It is not a demonstration objective that any subgroup show an improvement in turnover at the expense of another subgroup. The subgroup-by-subgroup distribution of the overall change within DS is simply a point of information.

Table 25 shows the overall DS separation and internal transfer (migration) rates during baseline (calendar year 1987) and during year two of PACER SHARE. The total turnover figures represent the sum of the separation and migration rates. Separations are defined as all who left their installation during the prior year (1987 for the baseline,

Table 25
Changes Associated with a Combination
of Interventions: Turnover
(measure VI.D.1 in evaluation model; in percent)

Type of Turnover	Sacramento Baseline Rate	Sacramento Baseline Diff. from Other ALCs	Year 2 Change for Other ALCs	Year 2 Change at Sacramento
Separations	10.8	2.3*	-3.0*	-3.7
Internal transfers (migration)	3.8	1.0*	0.8*	-1.1*
Total	14.7	3.3*	-2.2*	-4.7*

NOTE: Asterisk in column two or three indicates the coefficient is significant at the $p < .05$ level, in column four, it indicates the difference in the coefficients for columns three and four is significant at $p < .05$.

April 1989 to March 1990 for year two).² The denominator in the rate calculation is the total DS work force at Sacramento or in the comparison group at the end of the last month prior to the baseline year or the second year of the demonstration.

Baseline. Overall, the baseline turnover rate was nearly 15 percent at Sacramento. Turnover at Sacramento was significantly higher than for the comparison group. Analysis of the components indicates that separations were nearly 11 percent at Sacramento. The Sacramento rate was significantly higher than the average separation rate across the other ALCs. Internal transfer (migration) to other directorates at Sacramento was just under 4 percent, which also was significantly higher than for the comparison ALCs.

Year Two. Overall, turnover decreased by 2.2 percentage points at the comparison ALCs during year two of PACER SHARE. The drop in total turnover reflected an offsetting decrease in separation (-3.0 percentage points) and increase in migration (0.8 percentage points). These changes were all statistically significant. As compared with the other ALCs, internal transfers and total turnover decreased significantly at Sacramento. (Separations dropped as well, although the decrease did not differ significantly from that at the other ALCs.³) As a result, the year-two turnover rates were similar for Sacramento and the comparison ALCs. Because Sacramento had greater turnover at baseline, the change is consistent with a hypothesis of improved quality of work life. To the extent turnover actually becomes lower at Sacramento, the evidence will become even more persuasive.

Table 26 shows the separation and internal transfer rates by career category.

Baseline. Among career employees, the separation rate at Sacramento (11.4 percent) was significantly greater than at the other ALCs. The separation rate among career-conditional employees⁴ did

²Separations include retirements and deaths. We believe there is some merit to including retirements because, like resignations, they represent departure decisions that are at least partly under the control of the employee. Deaths in the work force are likely to be negligible.

³It could be argued that lower internal transfer rates are not indicative of improved quality of work life if they result from inability of employees to transfer because of institutional barriers posed by PACER SHARE.

⁴Career-conditional employees are full-time employees who have not yet met the three-year criterion for career employment privileges; at Sacramento, the category includes DOC employees after baseline (who have a one-year criterion).

Table 26
Changes Associated with a Combination of Interventions:
Turnover by Career Category
(measure VI.D.1 in evaluation model; percentage of career category)

Type of Turnover and Career Category	Sacramento Baseline Rate	Sacramento Baseline Diff. from Other ALCs	Year 2 Change for Other ALCs	Year 2 Change at Sacramento
SEPARATIONS				
Career	11.4	2.5*	-3.2*	-5.4*
Career-conditional	8.0	1.3	-1.7	12.0*
INTERNAL TRANSFERS (MIGRATION)				
Career	2.2	0.3	0.9*	0.3
Career-conditional	12.2	3.7*	-1.4	-6.0

NOTE: Asterisk in column two or three indicates the coefficient is significant at the $p < .05$ level; in column four, it indicates the difference in the coefficients for columns three and four is significant at $p < .05$.

not differ statistically between Sacramento and the comparison group. The internal transfer (migration) rate to other directorates at Sacramento was not significantly higher than for the comparison ALCs among career employees; however, it was significantly higher among career-conditional employees. When considered together with the separation results, the data indicate that, at baseline, most turnover among more senior (career) employees represented separations whereas among more junior (conditional) employees it represented transfers.

Year Two. The second-year changes for the comparison group in Table 26 indicate a significant decline in separations by career employees and a near-significant decline among career-conditional employees. Meanwhile, transfers went in opposite directions for the two groups—up among career employees and down among the career-conditional. The change for career employees was statistically significant, although it was not large in absolute terms (0.9 percentage points). Transfers remained higher among career-conditional workers. Unlike baseline, during year two the separation rate among career and conditional employees was similar ($11.4 - 2.5 - 3.2 = 5.7$; $8.0 - 1.3 - 1.7 = 5.0$).

Migration decreased at Sacramento within the two career categories relative to the comparison group; however, the decreases for the two individual categories were not statistically significant. (As noted, the total decrease for the two categories combined was significant.) Separations reveal a different and noteworthy pattern. Among career

employees, separations declined significantly at Sacramento relative to the comparison sites. Among career-conditional employees—DOCs and first-year employees at the start of the demonstration—the separation rate increased significantly at Sacramento. If this were linked to the intentional separation of DOCs or of employees who could not be converted to career status because of reduced workload, it would support the goal of increased flexibility in protecting the career force when making separations to accommodate reductions in workload. That link, however, is not yet established.

Table 27 shows turnover information by pay schedule.

Baseline. Overall, the results suggest that differences in turnover behavior between Sacramento and the comparison ALCs at baseline tended to occur among white-collar nonsupervisory personnel (who were paid less well relative to blue-collar nonsupervisors than at other ALCs, probably because of the effects of local wage surveys on blue-collar wages). The separation results indicate that such employees at Sacramento had a significantly higher separation rate. Among blue-collar nonsupervisory employees and among supervisors, the rates were statistically equivalent. Sacramento's internal transfer

Table 27
Changes Associated with a Combination of Interventions:
Turnover by Pay Schedule
(measure VI.D.1 in evaluation model; percentage of pay schedule)

Type of Turnover and Pay Schedule	Sacramento Baseline Rate	Sacramento Baseline Diff. from Other ALCs	Year 2 Change for Other ALCs	Year 2 Change at Sacramento
SEPARATIONS				
Blue-collar nonsupervisors (DH)	9.4	0.5	-2.7*	-3.2
White-collar nonsupervisors (DW)	11.2	3.5*	-2.6*	-2.5
Supervisors (DX)	14.6	3.5	-5.5*	-9.6
INTERNAL TRANSFERS (MIGRATION)				
Blue-collar nonsupervisors (DH)	1.8	0.5	2.1*	0.2*
White-collar nonsupervisors (DW)	6.3	1.7*	-0.4	-2.1
Supervisors (DX)	1.4	-0.2	-0.1	-0.8

NOTE: Asterisk in column two or three indicates the coefficient is significant at the $p < .05$ level; in column four, it indicates the difference in the coefficients for columns three and four is significant at $p < .05$.

rate also was higher than the comparison group's among white-collar nonsupervisory employees. For the other two pay schedules, transfer differences were not statistically significant.

Year Two. As can be seen in column three, the overall decrease in separations at the comparison sites during year two held true for all pay schedules. The increase in migration, however, occurred only among blue-collar nonsupervisors. As seen in column four, Sacramento separations showed declines within each pay schedule similar to those occurring elsewhere. The change in internal transfer rate also was comparable among supervisors and white-collar nonsupervisors across sites. Transfers, however, were significantly less common at Sacramento than elsewhere among blue-collar nonsupervisors; they did not reflect the increase seen at the comparison sites.

Finally, Table 28 shows turnover information by division.

Table 28
Changes Associated with a Combination of Interventions:
Turnover by Division
(measure VI.D.1 in evaluation model; percentage of division)

Type of Turnover and Division	Sacramento Baseline Rate	Sacramento Baseline Diff. from Other ALCs	Year 2 Change for Other ALCs	Year 2 Change at Sacramento
SEPARATIONS				
Materiel Processing (DSF)	9.3	0.9	-2.9*	-2.3
Management Services (DSM)	12.9	4.8*	-3.1*	-3.1
Quality Management (DSQ)	18.3	7.6	-5.4*	-13.9
Supply (DSS)	11.3	3.4*	-2.8*	-4.5
Transportation Operations (DST)	10.8	1.6	-2.7*	-3.2
INTERNAL TRANSFERS (MIGRATION)				
Materiel Processing (DSF)	3.4	1.1	1.8*	-1.5*
Management Services (DSM)	6.4	2.7	0.8	-3.4
Quality Management (DSQ)	0.0	-2.7	0.1	0.0
Supply (DSS)	5.0	1.2	-0.7	0.3
Transportation Operations (DST)	3.0	0.6	0.5	-0.6

NOTE: Asterisk in column two or three indicates the coefficient is significant at the $p < .05$ level; in column four, it indicates the difference in the coefficients for columns three and four is significant at $p < .05$.

Baseline. The data show some variation in turnover behavior. Separations for the Division of Management Services, Quality Management, and Supply were significantly or marginally higher at Sacramento. The Materiel Processing and Transportation Operations Division separation rates were similar for Sacramento and the comparison ALCs. The pattern of division transfer (migration) rates was more comparable across the ALCs. Only Materiel Processing and Management Services showed marginally more transfers at Sacramento. None of the other differences in Sacramento rates at baseline approached statistical significance.

Year Two. The results for year two indicate that the decrease in separations at the comparison sites was significant for all divisions, whereas migrations increased significantly only for DSF. The overall Sacramento pattern of separations relative to the other ALCs held true at the division level: the changes in separation rates were statistically equivalent to those at the comparison sites for each division. Migrations declined significantly at Sacramento for DSF and marginally for DSM relative to the changes for those divisions at the comparison sites. Changes in the migration rate were similar for the remaining divisions.

SUMMARY

We now summarize results from the automated personnel system. Our analysis indicates general improvement from baseline levels at Sacramento relative to changes at the other ALCs during this time period. Consistent with both increased organizational flexibility (greater salary potential through pay banding and annual increases) and quality of work life (higher pay), average salary growth in DS during the two-year period was greater at Sacramento than at the other ALCs. The change varied by pay band, but wages in the largest bands increased significantly relative to the comparison sites. Among continuing employees, salaries grew at a rate equal to or greater than those for comparable pay bands at the other ALCs. There was no evidence of pay inversion between supervisors and nonsupervisors. These results are noteworthy in showing that most employees fared as well or better financially under job series consolidation and pay banding than did their counterparts at the other ALCs—operating under the traditional system—despite the worsening of pay-related attitudes. In other words, pay dissatisfaction appears to be a matter of perception. Supplemental data suggest that the cost of living rose

more rapidly in the Sacramento area than at the comparison sites.⁵ During the demonstration period, Sacramento's cost of living rose approximately 10 percent more than the national average; at the comparison sites, the cost of living increased by approximately 5 percent less than the national average. This difference may have contributed to the worsening of pay satisfaction. The worsening of attitudes concerning the link between job performance and compensation or advancement, however, is more likely tied to the changes in annual salary increases and promotion practices under job series consolidation and pay banding. It also should be noted that the salary growth was offset by a reduction in the size of the work force. As discussed below, overall labor costs did not increase.

Two other measures of organizational flexibility concerned the number of skills per employee and the percentage of supervisors. Consistent with the goals of expanding training and increasing organizational flexibility, the average number of skills grew significantly more at Sacramento during the two-year period; that is, more skill training appears to have been provided, amounting to about one more skill for every three workers than at the other ALCs. In contrast, the percentage of supervisors remained unchanged, both overall and within divisions. Although this suggests that the flexibility provided by changes in supervisory grading criteria was not used to proliferate supervisory positions, it also suggests that the flexibility has not yet been fully utilized. (Movement of supervisors within divisions could have occurred.)

Finally, two measures of turnover were examined as they bear on the quality of work life and on hiring and separation practices. It was believed that the percentage of career employees might decrease if senior personnel were unhappy with PACER SHARE. In fact, the results show that the percentage of career employees grew significantly at Sacramento relative to that at the comparison sites during the two-year period. In addition to its consistency with possible improvement in the quality of work life, this outcome reflects fewer hiring actions taken at Sacramento to fill vacated positions, and it is consistent with the goal of retaining key personnel through the DOC program. Also consistent with greater quality of work life, the turnover rate decreased significantly at Sacramento. It thus became similar to that at the other ALCs, rather than maintaining its historically higher rate.

⁵*Composite Cost of Living Index*, American Chamber of Commerce Research Association, quarterly reports, 1985-1990.

5. RESULTS FOR WORK QUALITY MEASURES

We now consider measures of work quality (VI.B.1 in the evaluation model). As we indicated earlier, one of the goals of PACER SHARE was to maintain work quality while increasing productivity and, in the longer term, to improve quality as well. The quality measures evaluated fall into two groups: (1) measures of error rates for particular processes such as packing (Quality Management Division or DSQ measures) or as assessed in reports of discrepancies (RODs) in shipped (or received) items and (2) measures of success in meeting timeliness and support goals (Management Services Division or DSMPA measures). During the evaluation period, collection of data for reports of discrepancies and timeliness/support measures was directed by the Air Force Logistics Command (AFLC) and was performed consistently across the ALCs. Therefore, these measures afford a standard of comparison across the Air Logistics Centers and have been chosen to constitute the measures used in our analysis. This also applied to the DSQ error rate measures during the baseline and first-year periods. During year two, AFLC discontinued the directive to collect these data. As a result, we will restrict our analysis of error rate changes to Sacramento, where the measures continue to be collected under the prior procedures.¹ Monthly data observations for the ALCs covering 1985–1987 were combined to form the baseline period, and each month was weighted equally.² Each of the quality categories will be discussed in turn. Full annual site-specific results, regression analyses, and statistics for these measures are shown in App. D of N-3404-FMP.

ERROR RATES AND REPORTS OF DISCREPANCIES

Table 29 presents the results for the DSQ and ROD measures. Measures are distinguished by the area of work they pertain to and the particular error or problem rate they involve.

¹Additional measures can be maintained through local initiatives. In this manner, six of eight error measures previously included in our analysis were retained by Sacramento; monthly data collection for two storage measures was discontinued. New measures will be considered for inclusion in the evaluation in the future to the extent they become directed by AFLC or are sufficiently complete to afford meaningful comparisons.

²See R-3753-FMP for discussion of the analysis underlying this procedure.

Table 29
Results for Measures of Work Quality: Quality Division Indicators
(measure VI.B.1 in evaluation model; percentage of errors)

Work Area and Measure	Regression Coefficient			
	Sacramento Baseline Rate	Sacramento Baseline Diff. from Other ALCs	Year 2 Change for Other ALCs	Year 2 Change at Sacramento
QUALITY MANAGEMENT (DSQ) MEASURES				
<i>Supply</i>				
BL7: Controlled exceptions	7.3	5.2*		-4.1*
<i>Preservation, packaging, and packing</i>				
PL4: Packing process	1.1	-0.4*		1.2*
<i>Material processing and receiving inspection</i>				
RL2: Inspection	1.1	-1.0*		-0.9*
RL5: Tailgate accuracy	1.0	-2.8*		0.9
<i>Inventory</i>				
VL1: Location audit program survey	0.2	-0.2		-0.2*
VL3: Physical count of noncontrolled items	0.5	-1.9*		4.2*
RODs				
Received (percentage of issues)	0.2	-0.1*	-0.0	0.1
Initiated (percentage of receipts)	0.5	-0.4*	0.1	-0.0

NOTE: For DSQ measures, an asterisk indicates the coefficient is statistically significant at $p < .05$. For RODs, an asterisk in column two or three indicates the coefficient is significant at $p < .05$, or, in column four, that the difference between the coefficients in columns three and four is significant at $p < .05$.

We begin by looking at results of ordinary least-squares regression analyses performed for the DSQ and ROD measures of (monthly) error rates. The regression model employed was similar to that used in the multiple skill analyses reported in Table 19, except that, as noted, the DSQ measure analyses used year-two data for Sacramento alone (and t-tests were used to assess the significance of the two-year change at Sacramento relative to its baseline; see App. D of N-3404-FMP). If we read across the first row, we can see that the error rate prior to the demonstration on controlled exceptions (or BL7) was 7.3 percent. In this case, the regression coefficient shown in the next column indicates that the error rate was significantly higher than it was at the other ALCs by 5.2 percentage points; in other words, it was 2.1 percent at the other ALCs. The change at Sacramento during year two is shown in the last column. According to the results, the error rate decreased significantly by 4 percentage points.

If we look at the broad pattern of results, we note that with the one exception of the measure just discussed, error rates generally were in the area of 1 percent or less at baseline at Sacramento. As can be seen in the second column, the error rates at Sacramento tended to be lower than they were at the other ALCs, that is, there was better quality to begin with: on four of the six measures, the rate was significantly lower. Finally, column four indicates that, overall, year-two error rates at Sacramento tended to be comparable to those at baseline. Three measures showed significant improvement (BL7, RL2, and VL1), two showed significant increases (PL4 and VL3), and one showed no change (RL5). In short, then, work quality as assessed by the DSQ measures began at a superior level at Sacramento and the error rate across all measures remained about the same there through year two of the demonstration.

The lower portion of the table shows RODs. Reports of discrepancies indicate problems or inconsistencies with shipments from DS (RODs received) or, secondarily, with shipments into DS (RODs initiated). The ROD results show much the same pattern as for the DSQ measures. Error rates were generally 1 percent or less and were lower at Sacramento than at the other ALCs prior to the demonstration. During year two, there was no change at the other ALCs on these measures, and there was no differential change between Sacramento and the other sites.³

³In the case of RODs initiated, it can be argued that a higher rate results from greater scrutiny of receipts by DS, rather than poorer quality of receipts (a situation that one would like to see corrected over time). In this context, it may be noted that the difference in the rate of RODs initiated by Sacramento and the comparison ALCs is

TIMELINESS AND SUPPORT

In Table 30 we examine the Management Services Division measures of compliance with receiving timeliness and issue support goals. Receiving documents posted within standard (one day) and receipts binned within standard (two days) are both measures of receiving timeliness, with the optimum performance being 100 percent. The official goals are 90 and 70 percent, respectively. For the third and fourth measures, which pertain to shipping support, the lower the rate, the better.

The first column indicates the mean timeliness/support rate (in percent) during the baseline period for each measure at Sacramento. The baseline period extends from the date of publication of the current standard through December 1987. The period varies somewhat across the measures. The start dates are September 1985 for the first two measures, October 1985 for high-priority requisitions, and January 1985 for the denial rate measure. As before, the statistical

Table 30
Results for Measures of Work Quality: Management
Division Indicators
(measure VI.B.1 in evaluation model; percentage of receipts/issues)

Management Services (DSMPA) Measure	Sacramento Baseline Rate	Regression Coefficient		
		Sacramento Baseline Diff. from Other ALCs	Year 2 Change for Other ALCs	Year 2 Change at Sacramento
Receiving documents posted within one day (goal = 90%)	97.6	4.9*	4.4*	0.2*
Receipts binned within two days (goal = 70%)	82.7	9.4*	-0.8	-26.7*
High-priority requisitions (ceiling = 30%)	28.7	-2.8	-1.5	5.9*
Denial rate (ceiling = 1%)	1.0	0.2*	-0.1	0.2*

NOTE: Asterisk in column two or three indicates the coefficient is significant at the $p < .05$ level; in column four, it indicates the difference in the coefficients for columns three and four is significant at $p < .05$.

largely attributable to the initiation rate at Ogden, which is higher than the others. If we remove the Ogden data, the Sacramento results are comparable with those for the remaining ALCs.

significance of the Sacramento baseline rate as compared with the rate for the comparison group and changes during year two were evaluated using ordinary least-squares regression.

Overall, predemonstration timeliness indicators generally met applicable standards, and Sacramento ALC timeliness/support tended to be as good as or better than that at the other ALCs. The percentage of receiving documents posted and receipts binned within standard was significantly greater at Sacramento, and the percentage of high-priority requisitions was nonsignificantly lower. Denial rate measures the inability to fill a request for an item that was believed to be available. The Sacramento denial rate was significantly higher, although the difference was not large in absolute terms.

During year two, the percentage of receiving documents posted within standard improved at the other ALCs; there was no change in binning timeliness. On both these measures, however, timeliness decreased at Sacramento relative to the other ALCs. In the case of posting receiving documents, the timeliness rate at the other ALCs simply became more similar to Sacramento's, which already was close to 100 percent. However, there was a binning decrease at Sacramento. Some portion of the decrease in binning timeliness may be attributable to factors associated with the implementation of the Automated Warehouse System (AWS). The system's implementation schedule at Sacramento varies from that at other ALCs. For example, initially, AWS was implemented at Ogden, and timeliness did decline there in 1987 during phase-in, although that has not been definitively linked to implementation. Moreover, management emphasis on binning could change, because the AWS makes it possible to locate an item for shipment even if it is not yet binned. Additional data are required to examine the linkage at Sacramento and to distinguish unique factors from those common to other ALCs.

The third measure concerns high-priority requisitions. During year two, there was no significant change in that rate at the other ALCs. The rate rose by about 6 percentage points at Sacramento, however, representing a significant increase relative to the other sites. Sacramento believes that support for the F-15 program may account for the difference. Finally, during year two, there was no significant change in the denial rate at the other ALCs, which declined by .1 percentage points. At Sacramento, it increased by .2 points. The relative difference (.3 percentage points) was statistically significant, although it is not large in absolute terms.

SUMMARY

Our analysis of work quality focused on command-directed measures of error rates and RODs maintained by the Quality Division and measures of timeliness and support maintained by the Management Division. The error rates for controlled exceptions, packing process, receiving inspection, tailgate accuracy, location audit program survey, and physical count of noncontrolled items showed no overall pattern of change from baseline, at which time rates at Sacramento were superior to those at the comparison sites. Similarly, reports of discrepancies showed no overall pattern of change from baseline, remaining lower at Sacramento. Finally, there was a relative decline in timeliness and support—as assessed by receiving document posting, binning, high-priority requisitions, and denials—relative to the other ALCs. The two largest changes occurred for binning timeliness and requisitions and apparently are at least partially attributable to AWS implementation and management decisions such as support of the F-15.

6. ANALYSIS OF COST SAVINGS

We seek to learn whether PACER SHARE led Sacramento to achieve cost savings relative to what would have been expected from its pre-PACER SHARE performance, and more tellingly, whether PACER SHARE produced cost savings when judged in comparison with other ALCs' performance. Some turbulence occurs in any field demonstration, and that has been the case with PACER SHARE. Sacramento coped with a temporary hiring freeze in summer 1988, followed by a freeze beginning January 1990 and still in effect. Along the way, the Directorate faced prospects of base closure, absorption by the Defense Logistics Agency, and on-base reorganization. Still, there are common threads across the ALCs. Other ALCs in addition to Sacramento felt the hiring freezes and contemplated absorption by the Defense Logistics Agency. Although less pressing at other ALCs, base closure loomed as a possibility, as did reorganization. In addition, all ALCs experienced a workload reduction during 1987; although the other ALCs rebounded, Sacramento's workload remained lower through June 1990, the end point of our analysis. Despite turbulence and change, our analysis reveals substantial similarity across ALCs in factors affecting labor cost. This applies both to the baseline and the demonstration periods.

Three findings form the core of our results. First, although Sacramento did not pay gainshares during the first year of PACER SHARE, gainshares were paid in all but one quarter thereafter from winter 1989 through spring 1990.¹ For gainshares to be paid, current unit cost must be less than "would have" unit cost, which in PACER SHARE equals baseline average unit cost. Thus, the payment of gainshares offers some evidence of cost savings relative to Sacramento's baseline performance. Moreover, for reasons given below, we believe the PACER SHARE gainsharing formula *underestimated* the size of gainshares that could have been paid. Second, when analyzed, those cost savings were nevertheless not statistically significant. This holds despite the five-of-six-quarter string of gainshare payments. If Sacramento's recent performance continues, however, the greater accumulation of data might enable us to discern significant cost savings. As it is, the gainshare-related cost savings lie

¹A productivity cash award was paid in the first quarter of the first year, but it was not based on the productivity gainsharing formula. See App. B, Table B.5, for a listing of the gainshares paid by Sacramento.

within the range of values expected from baseline performance. Third, as in previous sections we place most weight on Sacramento's performance *compared with that of other ALCs*. The other ALCs reflect systemic patterns one might expect of Sacramento without PACER SHARE. In fact, their cost moved similarly to Sacramento's, so by this comparative yardstick Sacramento again showed no statistically significant cost savings.

This section reports the underlying analysis, focusing first on cost savings, then on gainshare determination. We describe how the current analysis relates to the year-one analysis, review the labor cost model, discuss hypotheses to be tested, and give regression results and hypothesis tests. We conclude with a discussion of the PACER SHARE gainsharing formula.²

RELATIONSHIP TO YEAR-ONE COST ANALYSIS

Our capability to evaluate cost savings under PACER SHARE has expanded significantly since last year. We have another year's worth of demonstration period data and, equally important, now have complete period data for all five ALCs. Further, output data come from the financial data system, which, because of its auditability and strict one-to-one correspondence with actual issues and receipts, surpasses the workload data system. For the first-year analysis, by comparison, we had partial data for two ALCs—San Antonio and Oklahoma City—and had to omit them from analysis. Also, because we were limited to comparisons between Sacramento and the pair Ogden and Warner-Robins, we conducted parallel analyses with output data from the financial system and the less-preferred workload system, hoping for robust results. The different data did not always produce the same insights, and there was no good way to resolve the differences. Having more of the better data avoids this problem.

The expanded database permits us to specify and estimate a more general model than before. We have taken advantage of this opportunity in several ways. First, using this model we found that neither of our previous models—one with unit cost as dependent variable, the

²That explanation discusses the current gainsharing formula, which differs from the one initially used. The original model determined baseline productivity through calculations that used earned hours, actual hours, and total costs. After evaluating various systems, however, it was determined that a measurement system based on unit or transaction costs would more accurately reflect actual savings. The quarterly transaction costs for 1985 through 1987, converted to current dollars, were averaged to determine the baseline transaction cost. The change is discussed in the March 30, 1990, *Federal Register*.

other with total labor cost as dependent variable but with a more restrictive specification of the time variable—was entirely satisfactory. Second, we now test hypotheses on whether intercept, time trend, and output effect taken as a set and individually differ between Sacramento and the other ALCs and, for Sacramento and the other ALCs, differ between baseline and demonstration periods. Previously, with our more limited models, hypothesis testing was confined to asking whether the time trend effects differed. Third, we now have enough data to explore whether the other ALCs are sufficiently similar to share the same cost structure, as had been assumed, or whether our results depend on an ALC's aberrant behavior. We do this by estimating our model separately for each ALC—Oklahoma City, Ogden, San Antonio, and Warner-Robins—visually comparing their estimates and running various pooled-data models. Finally, we test whether unit labor cost depends on output level. Although PACER SHARE's gainsharing formula assumes independence, we find dependence. We discuss the consequences of this disparity for the gainshare computation.

LABOR COST MODEL

We estimate labor cost as a function of an intercept, time, and output, as explained in Sec. 2. The *intercept* controls for fixed factors that can affect cost, such as plant, equipment, theaters served, weapons systems supported, work force skill and experience, and work force turnover. These factors are "fixed" in the short term but may change over a longer period. Change could result from factors felt throughout the AFLC system or ALC-specific events such as PACER SHARE. *Time* captures the net influence of changes cumulating during a period of analysis. This includes change in equipment, training, and procedures needed by the ALC to accomplish its materiel receiving, storing, and shipping functions. It also includes changes in the size, skill mix, and compensation level of the work force. Movement toward a larger work force, a work force requiring more training, or a higher-paid work force would exert upward pressure on labor cost over time, just as technical change, multiple skill training, and streamlined procedures might exert downward pressure. Controlling for the fixed factors and the time trend, the *output* effect describes the percentage change in labor cost per percent change in output. A higher workload demands more labor, hence labor cost should rise as output increases. But a 1 percent increase in output likely requires a less-than-1-percent increase in labor cost because incumbent workers often can work more intensively, and because added workers typically receive lower wages.

The intercept, time trend, and output effect are allowed to differ between baseline and demonstration periods, for both Sacramento and comparison ALCs. We estimate not only the parameters for each period but also the intercepts. Therefore, although the labor cost model has a simple structure, it can detect differences between Sacramento and comparison ALCs within a period, and differences for each between periods. The model's basic structure for an ALC in a period is:

$$\ln c_t = a_0 + a_1 t + a_2 \ln x_t + e_t.$$

Here, $\ln c_t$ is log labor cost in month t , a_0 is the intercept, t is the time variable measured in months, a_1 is the time trend (i.e., proportionate change in labor cost per month), $\ln x_t$ is log output measured as total issues and receipts in month t , and a_2 is the output effect (i.e., percentage change in labor cost per percentage increase in output).

HYPOTHESES TO TEST

If PACER SHARE interventions are effective in improving organizational flexibility, so that resources may be reallocated more rapidly and efficiently, and effective in creating incentives to encourage those reallocations, then Sacramento's cost should decline relative to that of other ALCs. Such a cost decline can result from lower cost at Sacramento relative to its base period cost, or higher cost at other ALCs relative to their base period cost, or of course lower cost both places but a greater cost decline at Sacramento. Interestingly, the pattern of cost changes may affect the success of PACER SHARE. Under the gainsharing formula, gainshares may be paid if Sacramento's unit labor cost declines relative to its baseline unit cost, and gainshares themselves may spur Sacramento to attain further cost reductions. But if unit cost does not decline at Sacramento, gainshares will not be paid and the feedback effect will not operate. There could even be an adverse effect if workers expect gainshares but receive none. Our evaluation methodology nevertheless could show Sacramento's cost declining relative to that of the other ALCs.

In evaluating cost savings, we are most interested in whether Sacramento's cost change from base period to demonstration period was less than the respective change at other ALCs. If so, we infer that Sacramento achieved cost savings relative to what would have been expected without PACER SHARE. In addition to the relative change hypothesis, we test a series of intermediate hypotheses. All the hypotheses implicitly compare the cost of producing a given level of output at a given time. This qualification is necessary because cost

generally depends on time and output level, that is, $c = c(t, x)$, and unless t and x are given the cost comparisons are ambiguous. For this reason it is not suitable simply to test average costs in the base period versus those in the demonstration period; these costs are unadjusted for time trend and output level. We use regression analysis to make the adjustments. Finally, for each of the cost hypotheses we also test three associated hypotheses concerning the intercept, time trend, and output effect; they help isolate the sources of cost differences, if any.

Hypothesis 1: Cost is the same at Sacramento and other ALCs during the base period. We expect this hypothesis to be rejected because of intrinsic differences in the ALCs reflecting different physical layouts and workload mixes (beyond what we can measure with our output data). The workload mix depends on the mission assigned to the ALC such as which theaters and weapons systems the ALC primarily supports.

Hypothesis 2: Cost is the same at other ALCs in the demonstration period as in the base period. By looking at other ALCs we learn what happened within the system and hence what would be expected to happen at Sacramento were PACER SHARE not introduced. Cost at the other ALCs may have declined, remained constant, or risen relative to the base period. Whatever the pattern, it is the backdrop for judging Sacramento.

Hypothesis 3: Cost is the same at Sacramento in the demonstration period as in the base period. If PACER SHARE increases productivity, then cost in the demonstration period should be lower than at baseline and the hypothesis rejected. As mentioned, a cost reduction must occur for the payment of gainshares at Sacramento. Still, this hypothesis is an incomplete test of PACER SHARE's effect on cost because it neglects what is happening at other ALCs.

Hypothesis 4: Cost is the same at Sacramento and other ALCs during the demonstration period. A counterpart to hypothesis 1, this hypothesis could be rejected because of differences in mission and physical layout. Still, it is possible Sacramento's and other ALCs' costs changed in such a way as to make them equivalent during the demonstration.

Hypothesis 5: Sacramento's cost change from baseline to demonstration period is the same as other ALCs' cost change from baseline to demonstration period. This hypothesis incorporates information from all previous hypotheses and provides a comparative assessment of Sacramento's performance under PACER SHARE. We might find Sacramento's cost declined and did so more rapidly than other ALCs';

or we might find Sacramento's cost did not decline but other ALCs' cost rose—either pattern would indicate cost savings under PACER SHARE and the hypothesis would be rejected. If the hypothesis is not rejected, there is no statistically significant evidence of PACER SHARE cost savings.

REGRESSION RESULTS

To implement our approach we needed to determine a suitable way of pooling data on other ALCs for the purpose of comparing Sacramento's cost with theirs. We sought a pooled-data model that reflects "typical" ALC behavior, and we chose to judge typicality by referring to labor cost equations estimated for other ALCs individually. We began by estimating the regressions by ALC, then considered various alternatives for a pooled-data regression. During these steps we found Oklahoma City's results to be anomalous and decided to drop the ALC from the comparison group. We pursued two pooled-data models, one having a single intercept, time trend, and output effect in each period, and the other having an intercept for each included ALC (Ogden, San Antonio, Warner-Robins) but a single time trend and output effect in each period. We prefer the latter model because of its better fit to the data and closeness to the individual ALC results. However, for completeness we discuss the former model in App. B; we also include the labor cost and output data by ALC in App. C. Below we give relevant data plots, labor cost regressions by ALC, the multiple-intercept pooled model results versus Sacramento's, and the hypothesis tests.

Figure 1 displays labor cost and output over time by ALC. The figure shows a close correspondence between those variables, suggesting that the labor cost model will perform adequately at the ALC level. Labor cost tracks output equally well in the demonstration and base periods, so the model should be effective in both periods. An exception is Oklahoma City, which has a weaker association between output and labor cost during baseline. Also, as seen, Sacramento's output fell and remained low, while other ALCs' output fell and rebounded. These patterns pertain especially to the gainsharing discussion below.

Labor cost regressions for each ALC appear in Table 31. We found evidence of similarity across the ALCs in both periods, supporting the case that a regression based on other ALCs' pooled data will accurately represent the system, which we seek for comparison with Sacramento. In the baseline period we see (1) similar intercepts with

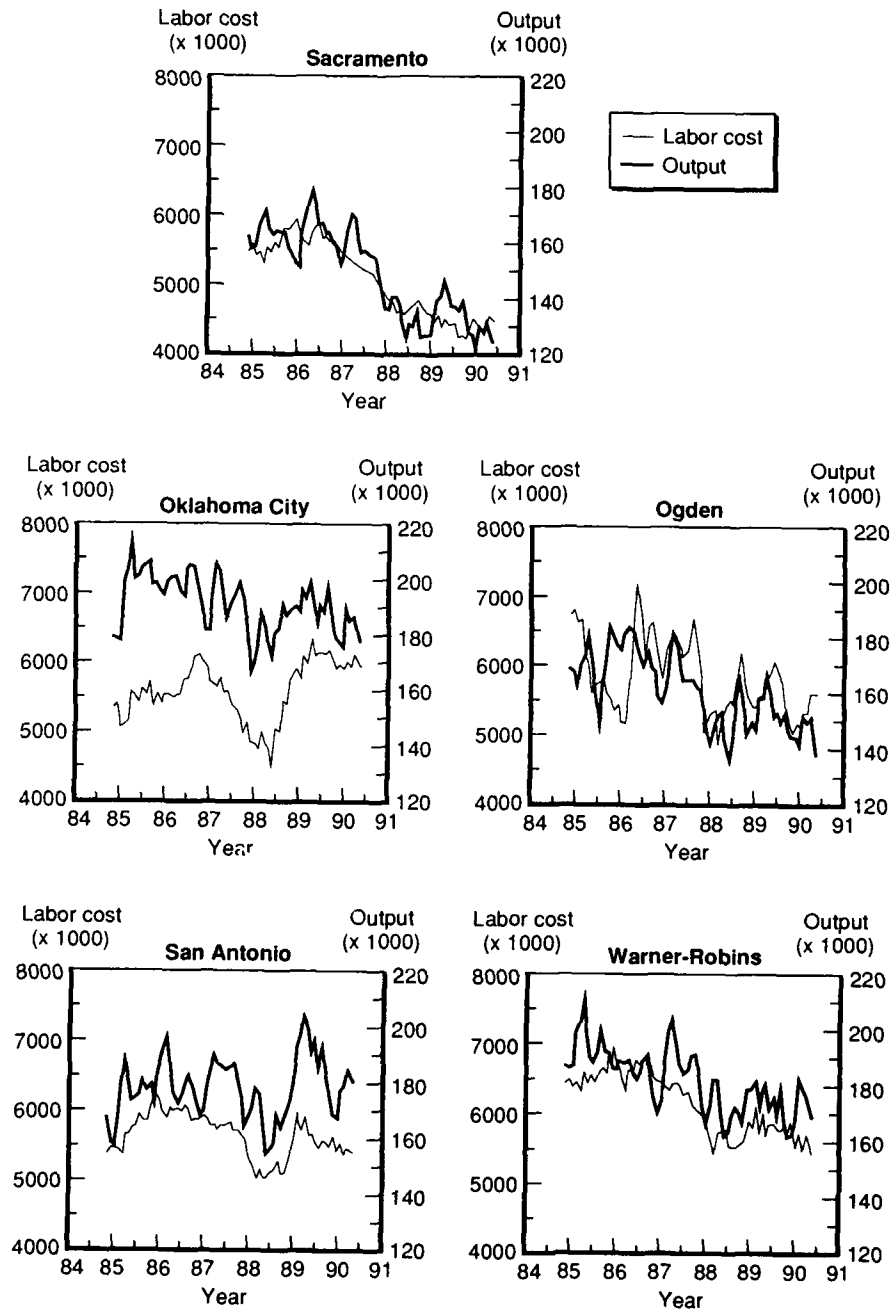


Fig. 1—Labor Cost and Output by ALC, Three-Month Moving Average

Table 31
Labor Cost Regressions by ALC
 (dependent variable: \ln labor cost)

Variable	Sacramento	Oklahoma City	Ogden	San Antonio	Warner-Robins
BASELINE PERIOD					
Intercept	11.28 (2.86)	12.04 (2.03)	11.57 (2.13)	13.43 (2.50)	13.55 (2.71)
Time	-.0019 (.0014)	.0008 (.0010)	-.0009 (.0012)	.0009 (.0012)	-.0011 (.0012)
\ln output	.36 (.24)	.28 (.17)	.33 (.18)	.18 (.21)	.18 (.22)
DEMONSTRATION PERIOD					
Intercept	13.81 (2.69)	4.08 (2.30)	11.57 (2.18)	10.20 (2.17)	12.84 (2.32)
Time	-.0026 (.0019)	.0091 (.0016)	.0000 (.0018)	.0015 (.0019)	-.0001 (.0017)
\ln output	.14 (.23)	.90 (.19)	.33 (.18)	.43 (.18)	.22 (.19)
Adj. R-square	.77	.16	.53	.43	.56
Standard error of estimate	.06	.11	.07	.05	.06

NOTE: Standard errors are in parentheses.

values ranging from 11.57 to 13.55, all within roughly one standard error of each other, (2) seemingly different time trends but all within two standard errors of one another, and (3) output coefficients ranging from .18 to .33, yet again within one standard error of each other. The same points hold across the other ALCs in the demonstration period (except for Oklahoma City) and also between the base period and demonstration period. Indeed, Oklahoma City's demonstration period coefficients and its low R-square (poorer fit) are an exception to the pattern.

We next estimated pooled-data models for all other ALCs. Generally, Oklahoma City exerted a strong influence, making the results atypical of the ALCs. A single-intercept model with Oklahoma City is reported in Table B.2, and we also fit multiple-intercept models including Oklahoma City. Based on these pooled regressions as well as Oklahoma City's own estimates, we deleted Oklahoma City from the

pooled data. Even though Oklahoma City is absent, in what follows we refer to the remaining threesome as "other ALCs."

Motivation for the multiple-intercept model over the single-intercept model comes from Fig. 2, which plots \ln labor cost against \ln output. The separate clusters of points by ALC have similar orientations, providing justification for assuming a common output effect. The clusters do not overlay one another, however, but are shifted left or right, indicating different output ranges. Given the similar cluster shapes but different locations, a model with a common output effect and multiple intercepts seems well suited. Further, judging from Fig. 1 (showing labor cost by time) and in view of the regressions by ALC, it is reasonable to specify a common time trend.

In contrast to the multiple-intercept model, the single-intercept model treats the pooled cluster of points as a unit. As Fig. 2 shows, the orientation of the pooled cluster differs from the ALC clusters. The difference is subtle at baseline but pronounced in the demonstration period, where the pooled cluster has an elongated shape and more horizontal orientation. It is therefore not surprising that the single-intercept model has a high intercept and low output effect in the demonstration period (see Table B.1), with values lying outside the individual ALC range.

The multiple-intercept regression, shown in Table 32, appears representative of the other ALCs and consequently affords a good basis for hypothesis tests. The regression fits the data well, displaying fidelity to the individual ALC results given before. Notably, each coefficient lies in mid range of the latter, which is not true of the single-intercept model.

As compared with the baseline period, during the demonstration period the other ALCs' intercepts decline by roughly a unit, the time trend changes from a small negative trend to a small positive one, and the output effect rises. In contrast, Sacramento's intercept increases from baseline to demonstration period, the time trend becomes a stronger negative effect, and the output effect falls. Although Sacramento's and other ALCs' coefficients change between the baseline and demonstration periods, the changes fall within one or, for the time trend, two standard errors. These are not large differences from a statistical perspective.

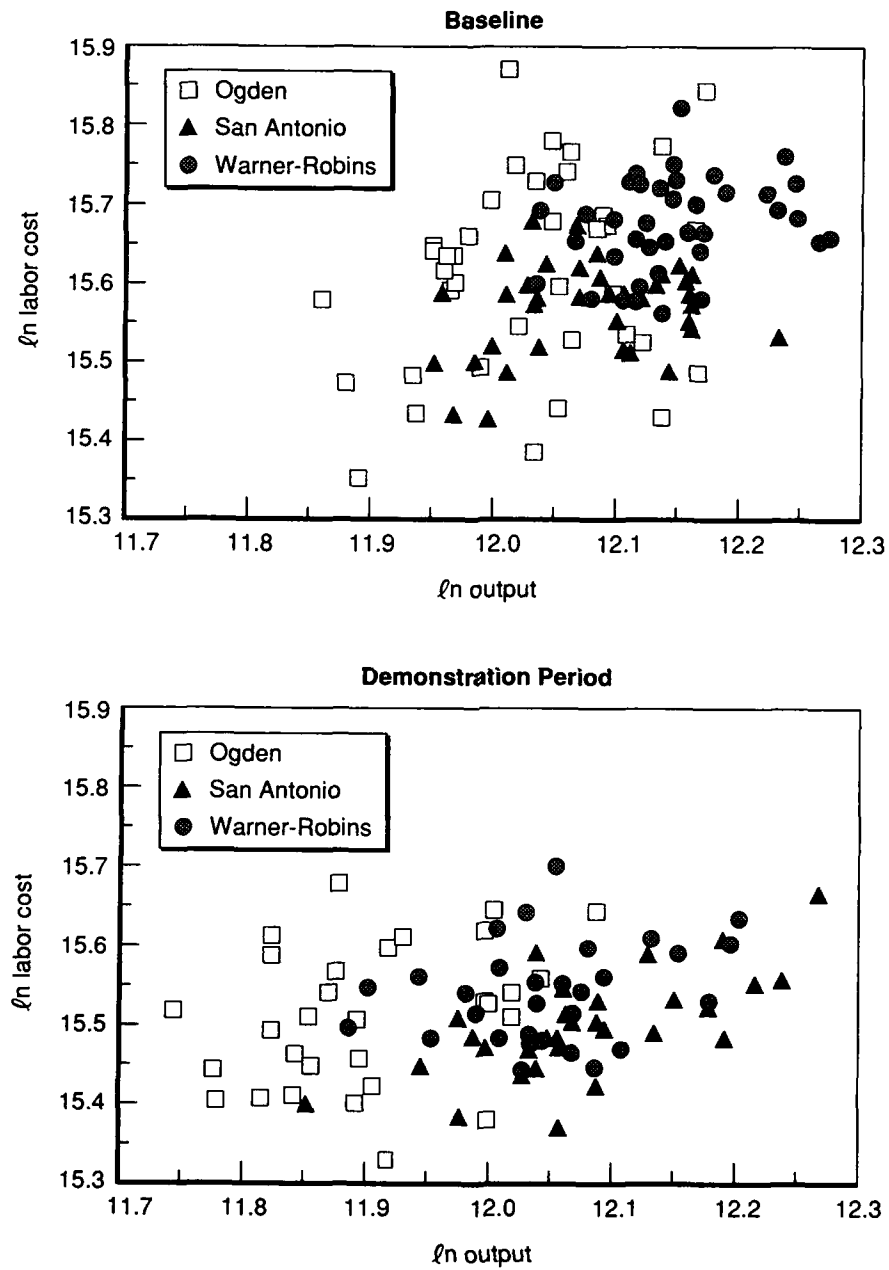


Fig. 2—ln Labor Cost vs. ln Output by ALC

Table 32
Labor Cost Regressions: Sacramento
vs. Comparison Group
(dependent variable: \ln labor cost)

Variable	Sacramento	Other ALCs
BASELINE PERIOD		
Intercept		
Sacramento	11.28 (2.86)	
Ogden		12.26 (1.25)
San Antonio		12.21 (1.26)
Warner-Robins		12.30 (1.26)
Time	-.0019 (.0014)	-.0004 (.0006)
\ln output	.36 (.24)	.28 (.10)
DEMONSTRATION PERIOD		
Intercept		
Sacramento	13.81 (2.69)	
Ogden		11.27 (1.16)
San Antonio		11.19 (1.18)
Warner-Robins		11.25 (1.17)
Time	-.0026 (.0019)	.0006 (.0009)
\ln output	.14 (.23)	.35 (.10)
Adj. R-square	.77	.41
Standard error of estimate	.06	.08

NOTE: Standard errors are in parentheses.

HYPOTHESIS TEST RESULTS

We present hypothesis test results in Table 33. The tests are based on a pooled-data regression rather than on the separate regressions reported in Table 32. Pooling the data ensures a common estimated

Table 33
Hypothesis Test Results Using Warner-Robins Intercept

H1 hypotheses: Sacramento versus other ALCs during baseline period.				
	ln Cost	Intercept	Time Trend	ln Output
Equal?	Reject	Accept	Accept	Accept
Probability	.0001	.71	.26	.73
H2 Hypotheses: Other ALCs, demonstration versus baseline periods.				
	ln Cost	Intercept	Time Trend	ln Output
Equal?	Reject	Accept	Accept	Accept
Probability	.0013	.52	.38	.58
H3 Hypotheses: Sacramento, demonstration versus baseline periods.				
	ln Cost	Intercept	Time Trend	ln Output
Equal?	Accept	Accept	Accept	Accept
Probability	.21	.45	.69	.44
H4 Hypotheses: Sacramento versus other ALCs during demonstration period.				
	ln Cost	Intercept	Time Trend	ln Output
Equal?	Reject	Accept	Reject	Accept
Probability	.0001	.31	.08	.32
H5 Hypotheses: Change at Sacramento, demonstration versus baseline periods, versus change at other ALCs, demonstration versus baseline periods.				
	ln Cost	Intercept	Time Trend	ln Output
Equal?	Accept	Accept	Accept	Accept
Probability	.68	.34	.44	.35

error variance. The pooled regression gives the same coefficients as appear in Table 32, but the standard errors are slightly different because of the pooling. Given the high degree of similarity in the standard errors in the separate versus pooled models, either approach would produce virtually the same hypothesis test results. We use the pooled regression because a common error variance simplifies computing the tests.³ As mentioned, we test for equality of labor cost between Sacramento and other ALCs during baseline and during the demonstration period, equality at Sacramento between periods,

³In estimating the pooled model we also tested for autocorrelation. Specifically, we estimated models allowing for (1) first-order autocorrelation and (2) first- through sixth-order autocorrelation. In both cases the estimates and standard errors changed very little from the basic model, assuming no autocorrelation. The Durbin-Watson statistic for (1) was 1.65, indicating only borderline autocorrelation at most. As a result of this exercise, we are confident that the hypothesis test results are robust to autocorrelation; had we used the results from (1) or (2) the hypothesis test results would have been the same as obtained for the basic model, whose results are reported in Table 33.

equality at other ALCs between periods, and equality of cost change at Sacramento relative to that at other ALCs. In addition, we conduct similar tests for intercept, time trend, and output effect estimates. Because we use a multiple-intercept model, we also must choose which intercept to use in the tests. In fact, we performed separate sets of tests using each of the three intercepts and obtained much the same results. For present purposes it is therefore enough to present one set of results, which we do using Warner-Robins' intercept. (Other test results are available on request.)

Tests of cost hypotheses ask whether after controlling for time and output, two costs are statistically equivalent. For example, hypothesis 1 asks whether Sacramento and other ALCs have the same cost at baseline: if $c(\text{SM}, B; t, x)$ and $c(\text{Other}, B; t, x)$ represent baseline costs, are the two costs equal for a given t and x ? To control for t and x one can use the regression coefficients to predict costs at any given t and x , obtaining estimates of what costs would have been had Sacramento and other ALCs produced the same output at the same time. But making such predictions is unnecessary. Because t and x are the same in these predictions, any difference in predicted costs necessarily comes from the regression coefficients. Thus the test for cost equality reduces to a test of equality between Sacramento's and other ALCs' intercepts, time trends, and output effects, taken as a set. The F-statistic is appropriate for this test, just as for tests of equality between individual coefficients.

Entries in Table 33 state whether the hypothesis is rejected or not ("accepted") and give the probability of the F-statistics in the particular test. A value of .26, for instance, means that the chance of observing a value of the test statistic greater than that computed in the test is 26 percent, assuming the hypothesis is true. In other words, the outcome would be moderately common and the results are consistent with the hypothesis. The value of .26 is well above usual levels of statistical significance for rejecting an hypothesis, which are perhaps .10 or, more typically, lower (.05 or .01). On the other hand, if the probability of the test statistic is below the significance level, the hypothesis is rejected.

The results of the hypothesis tests are consistent with the following statements: (1) Sacramento's intercept, time trend, and output effect, when taken individually, are the same as other ALCs' at baseline. However, when the coefficients are viewed as a group, Sacramento differs from other ALCs. This occurs because the sets of coefficients are more precisely measured than are single coefficients. Still, the results suggest that Sacramento and the other ALCs are reasonably

comparable at baseline, thereby providing a foundation for the further hypothesis tests. (2) Other ALCs' cost differs between baseline and demonstration periods. The factors driving this difference are (non-significant) changes in the intercept, time trend, and output effects. The intercept becomes smaller and the output effect larger, for instance. (3) Sacramento's coefficients also change, but on net not by enough to result in a significant cost difference between baseline and demonstration periods. This result partly reflects the smaller precision of Sacramento's estimates due to its smaller sample size than the other ALCs' pooled-data sample. (4) Sacramento's cost differs from other ALCs' cost in the demonstration period. The difference in time trend undoubtedly contributes to this result—Sacramento's trend is $-.0026$, other ALCs', $.0006$. (5) The change in Sacramento's cost from baseline to demonstration periods is the same as the change in other ALCs' cost. This is, of course, the most important hypothesis test. By implication of statements (3) and (5), *the results indicate no statistically significant PACER SHARE cost savings, judging either from Sacramento's performance under PACER SHARE as compared with its previous performance, or, as our approach emphasizes, the change in its performance relative to that of other ALCs.*

Nevertheless, the gainsharing discussion below presents figures based on the regression analysis that reveal a tendency toward cost savings at Sacramento relative to its baseline. Sacramento's cost savings, although not (yet) statistically significant, may therefore be incipient. On the other hand, we find a similar pattern of potential cost savings at other ALCs. Therefore, under PACER SHARE Sacramento may be outperforming its past, and other ALCs without PACER SHARE may be outperforming their past too.

GAINSHARING

PACER SHARE's gainsharing formula determines the money available for the gainshare pool (g_t)—half of which is returned to the Air Force—as a function of the difference between baseline and current unit cost times current output:

$$g_t = \begin{cases} [(c_0 / x_0) - (c_t / x_t)](x_t) & \text{if right hand side} > 0 \\ 0 & \text{otherwise} \end{cases}$$

The gainshare pool is positive if current unit cost is less than baseline unit cost. If current unit cost exceeds or equals baseline unit cost, the gainshare is zero. The formula thus rewards improved productivity

(lower unit cost) with respect to Sacramento's baseline without penalizing reduced productivity. The formula is easily implemented and draws data from the financial system, the same data system we use.

The formula's simplicity engenders a deficiency, however. The formula should conceptually depend on the difference between what would have been the unit cost of current output and what it was, but in practice "would have" unit cost equals a single number, average baseline unit cost. This approach rules out the possible dependence of unit cost on level of output.

Whether unit cost depends on output cannot be readily inferred from tables or plots routinely available to ALC management, namely, data on unit cost by month. Such data, plotted in Fig. 3, show little time trend in unit cost except for Oklahoma City in the demonstration period. Even bringing to mind the output plot by month given in Fig. 1, the eye cannot determine whether and to what extent unit cost depends on output level. The unit cost plots offer no reason *not* to define a gainsharing formula where "would have" cost is independent of output.

Our model, in contrast, can be used to determine the presence and extent of dependency. The labor cost model is:

$$\ln c_t = a_0 + a_1 t + a_2 \ln x_t + e_t$$

Subtracting $\ln x_t$ from both sides gives an average cost equation:

$$\ln (c_t / x_t) = a_0 + a_1 t + (a_2 - 1) \ln x_t + e_t$$

Here, a 1 percent increase in x relates to an $(a_2 - 1)$ percent change in unit cost, c/x . We can use the estimated coefficient a_2 to test the independence assumption: if $(a_2 - 1)$ differs significantly from zero, the independence assumption is rejected.

The intuition behind the importance of adjusting for the dependence of unit cost on output level can be described by differentiating the gainshare equation with respect to output. (Readers not interested in this detail may want to skip ahead.) We allow "would have" unit cost first to depend on output, then assume it does not. In the first case:

$$g_t' = \left[(c_0 / x_0)' - (c_t / x_t)' \right] (x_t) + [(c_0 / x_0) - (c_t / x_t)]$$

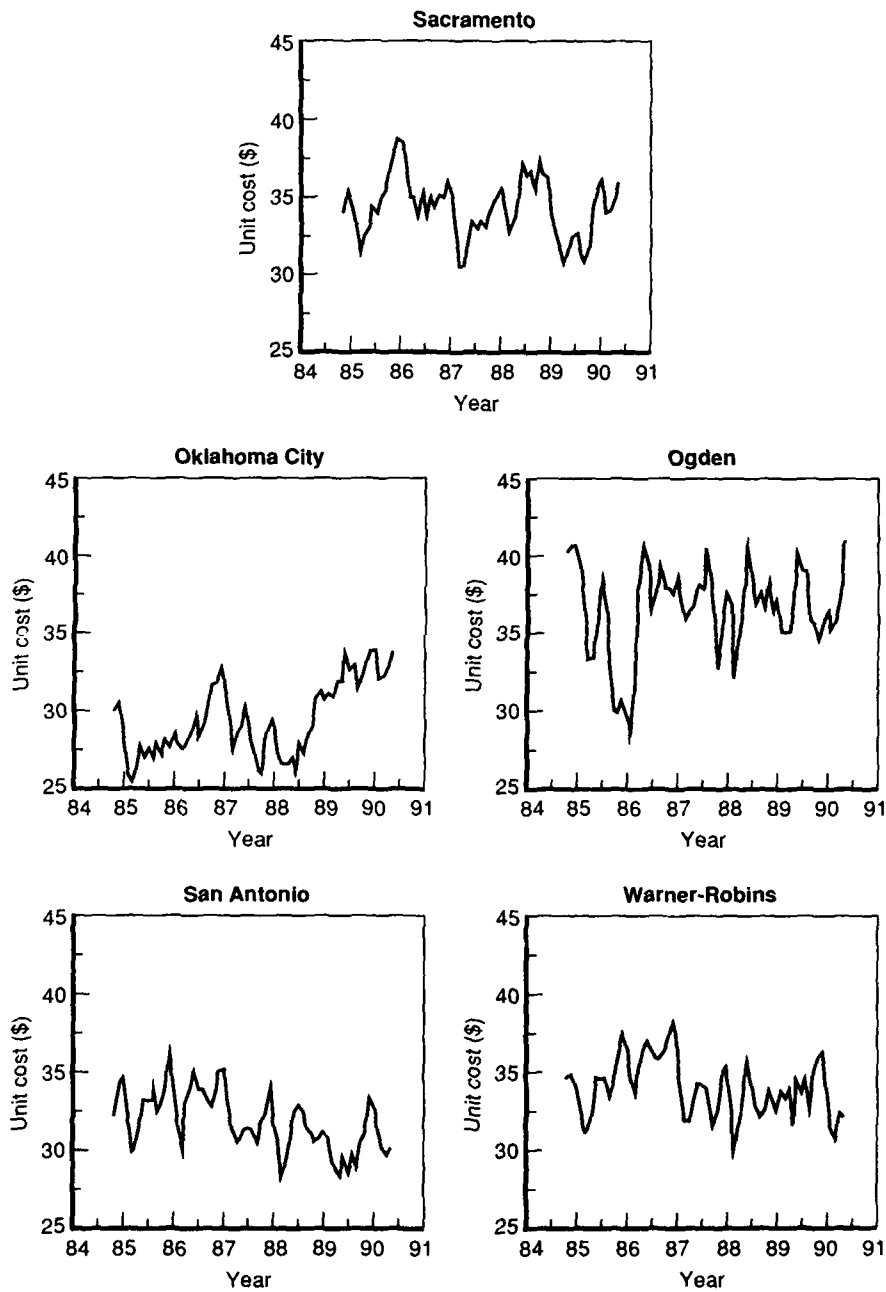


Fig. 3—Unit Cost Trend by ALC, Three-Month Moving Average

The first term in brackets on the right-hand side is the indirect effect of a change in output as it is felt through "would have" unit cost and current unit cost, respectively. If the production structure and efficiency remain largely the same, these incremental effects on the unit costs would be nearly zero, and as a result the first term would vanish. The second term is the direct effect of a change in output and equals the difference between "would have" and current unit cost.

In the second case, representative of the PACER SHARE gainshare formula, "would have" unit cost does not vary with output, hence the effect of output on it is constrained to be zero. The above equation becomes:

$$g_t' = \left[- (c_t / x_t)' \right] (x_t) + [(c_0 / x_0) - (c_t / x_t)]$$

The difference between the constrained and unconstrained derivatives is the term $-(c_0 / x_0)'(x_t)$. Our regression results show that unit cost falls as output increases, so the unit cost derivative in this term will be negative in reality and the overall term will be positive. Therefore the gainshare as output *increases* will be *larger* under the PACER SHARE formula than under the more general case where "would have" unit cost is adjusted for change in the level of output. For Sacramento, which experienced a rapid and substantial *decline* in its workload just before PACER SHARE began, it follows that PACER SHARE gainshares were *below* what they would have been had output level remained the same.⁴

When we test for independence of unit cost from output, the results clearly reject it (Table 34). Sacramento's regression results imply that a 1 percent increase in output is associated with about a .6 percent drop in unit cost at baseline and a .8 percent drop during demon-

⁴A rough idea of this decrease may be obtained as follows. From the unit cost equation

$$d \ln (c/x) / d \ln x = (a_2 - 1) = -.7 \text{ approx.}$$

so

$$d(c/x) / dx = -.7 (c/x) / x$$

We therefore obtain the following valuation:

$$-(c/x)' x = .7 (c/x)$$

Actual unit cost has not changed much at Sacramento from baseline to demonstration periods (Fig. 3), hence the contribution of $[(c/x)_0 - (c/x)_t]$ to the derivative is very small, whereas the term $.7 (c/x)$ makes a large contribution to the gainshare derivative. This analysis is borne out in Table 35 and Fig. 4, showing larger gainshares when "would have" unit cost is adjusted for the decrease in output occurring during the onset of PACER SHARE.

Table 34
Tests for Independence of Unit Cost from Output

Site	$a_2 - 1$	t-value	Reject Independence ($a_2 - 1$) = 0?
BASELINE			
Sacramento	-.64 (.23)	-2.8	yes
Other ALCs	-.72 (.10)	-7.2	yes
DEMONSTRATION			
Sacramento	-.86 (.24)	-3.6	yes
Other ALCs	-.65 (.09)	-7.2	yes

NOTE: All t-values exceed the .01 significance level of 2.4. Estimates of a_2 come from Table 32. Standard errors are in parentheses.

stration period. For other ALCs the response is about .7 percent either period, not much different than Sacramento. What are the implications for the gainsharing computation?

The dependence of unit cost on output has little importance for gainsharing if workload had remained the same from baseline to the demonstration period. But Sacramento's workload fell by 20 percent (Fig. 1), enough to increase unit cost by about 14 percent if we use an intermediate .7 estimate for Sacramento's output effect on unit cost. Unit cost, in other words, would have been about 14 percent higher because of the output change alone—without any change in operating efficiency.

Table 35 shows how the dependence of unit cost on output affects the gainshare computation for Sacramento. The table shows production, cost, and gainshare figures based on setting "would have" unit cost equal to average baseline unit cost and, alternatively, with it equal to adjusted baseline unit cost. (The computations are illustrative, not official gainshare computations.) The first two columns give output and labor cost, and the third column, the ratio of labor cost to output, or unit cost. Next come two versions of "would have" unit cost: baseline average unit cost, a constant, and adjusted baseline unit cost, a quantity predicted from Sacramento's baseline regression and there-

Table 35
Sacramento Gainshare Pool Adjustment Computation
(including Air Force share)

Demonstration Quarter	Baseline Unit Cost				Gainshare Pool						
	Output	Cost	Cost/ Output	Un- adjusted	Adjusted	Adjusted + se	Adjusted - se	Un- adjusted	Adjusted	Adjusted + se	Adjusted - se
1988											
Winter	420,228	14,192,989	33.77	34.45	35.79	38.04	33.67	285,673	846,717	1,791,099	(41,869)
Spring	391,096	13,753,377	35.17	34.45	37.25	39.59	35.05	(278,438)	816,533	1,731,416	(44,296)
Summer	389,216	14,159,136	36.38	34.45	37.30	39.64	35.09	(748,971)	358,099	1,269,674	(499,618)
Fall	378,613	13,793,022	36.43	34.45	37.66	40.03	35.44	(748,176)	467,100	1,362,531	(375,426)
1989											
Winter	417,296	13,611,868	32.62	34.45	35.18	37.39	33.10	765,774	1,067,120	1,988,852	199,846
Spring	423,673	13,348,426	31.51	34.45	34.64	36.81	32.59	1,248,931	1,325,763	2,247,194	458,772
Summer	406,656	12,726,166	31.29	34.45	35.40	37.62	33.31	1,284,882	1,668,856	2,572,757	818,360
Fall	381,255	12,964,237	34.00	34.45	36.70	39.00	34.53	171,638	1,027,750	1,906,343	201,066
1990											
Winter	387,277	13,131,109	33.91	34.45	36.12	38.38	33.98	212,249	856,148	1,734,445	29,744
Spring	373,820	13,395,454	35.83	34.45	36.68	38.98	34.51	(515,747)	316,413	1,177,418	(493,720)

NOTE: All in dollars except output. Values imputed using coefficients:

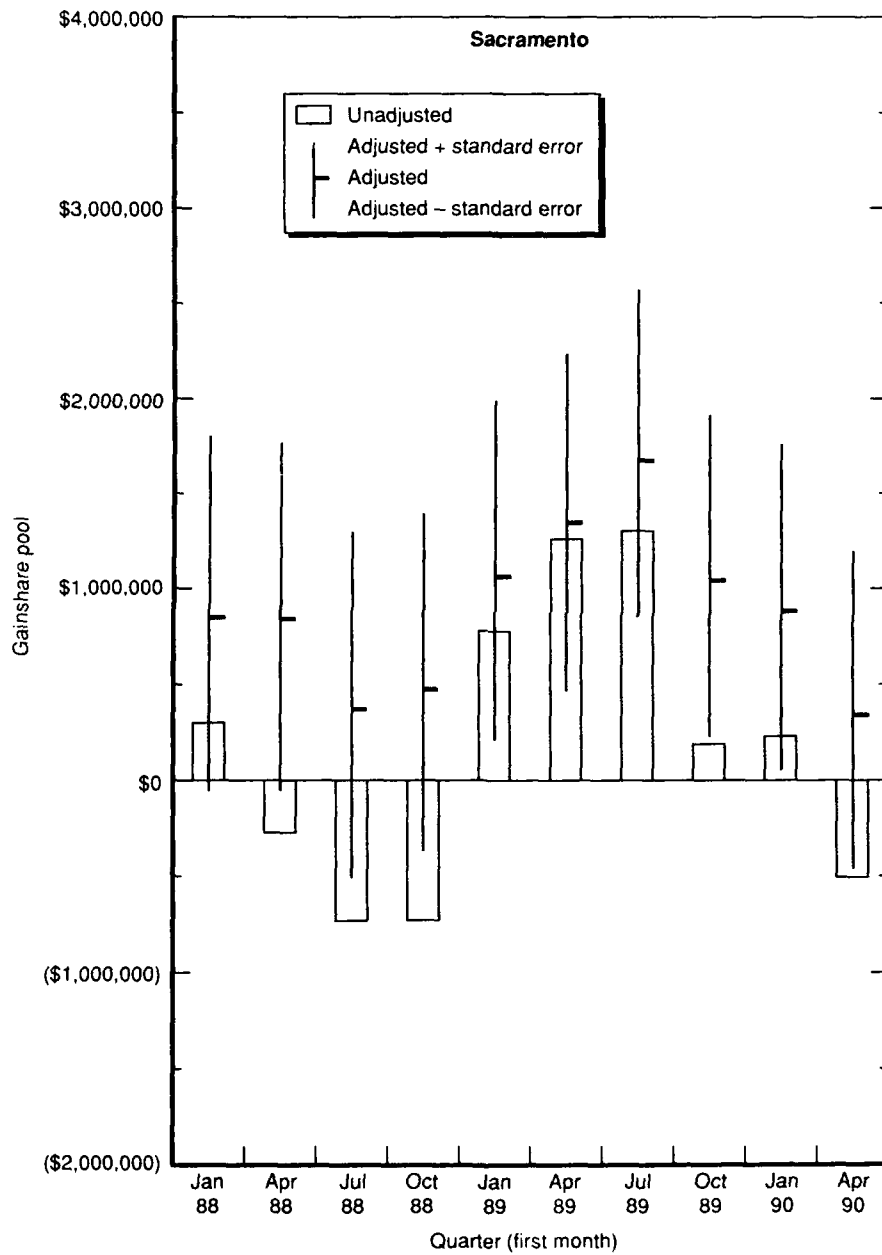
Baseline intercept 11.2800
 Baseline trend -.0019
 Baseline output .3562
 se .0609

fore depending on time and output.⁵ These alternative versions enter the gainshare formula to produce unadjusted and adjusted gainshare amounts: $\text{gainshare} = (\text{"would have" unit cost} - \text{current unit cost}) \times \text{current output}$. In addition, we give adjusted "would have" unit costs for a standard error above and below the regression prediction, and also compute gainshares for those values. Negative values are shown in parentheses.

From PACER SHARE's viewpoint, the most important figures in the table are the gainshares. As expected, adjusting for output level makes a major difference in gainshare size. All adjusted gainshares are positive and often substantially larger than the unadjusted gainshares, of which four of ten are negative. The adjusted gainshares plus a standard error loom still larger, of course, but the adjusted gainshares minus a standard error are less than the unadjusted gainshares about half the time. We depict the gainshares in Fig. 4, which shows the unadjusted, adjusted, and adjusted-plus and -minus one standard error. We conclude that our adjustment produces larger gainshares not only for our best estimate (the regression prediction) but also for a reasonable range around that estimate. Still, at two standard errors below the prediction the adjusted gainshares are less than zero, a fact echoing the finding of no statistically significant cost savings at Sacramento relative to its baseline.

Although the adjusted gainshares exceed the unadjusted gainshares, the question of whether paying higher gainshares would have induced greater productivity remains open. We frankly expect higher gainshares to create stronger feedback, bringing forth more effort, creating higher gainshares, and so forth. But how much stronger remains an empirical question. The effect might be weak if gainshare size bears little relationship to worker effort, a possibility given the per capita distribution of gainshares. Generally speaking, without a clear

⁵As in the regressions, cost figures have been inflated to constant 1989 dollars; see Sec. 2 for inflation factors. Adjusted baseline unit cost is estimated in several steps: monthly log unit cost is predicted from the baseline unit cost regression evaluated at current time and output level, that is, $\ln(c_t/x_t) = 11.28 - .0019t - .64\ln x_t$; because we assume cost, hence unit cost, to be lognormally distributed, predicted unit cost equals $\exp(\text{predicted log unit cost} + 1/2s^2)$, where s is the standard error of estimate, .057 for Sacramento. Predicted monthly unit cost is then averaged on a quarterly basis. Although table entries for unadjusted gainshares are not official, they are close to Sacramento's official values. They differ in that Sacramento made certain, usually minor, adjustments to current average cost before entering it in the gainshare formula. However, in the final quarter where we depict a negative gainshare, Sacramento in fact declared a positive gainshare.



**Fig. 4—Sacramento Gainshare Pool (Including Air Force Share):
Adjusted vs. Unadjusted**

connection between effort and reward workers may have little reason to work harder; if they believed in such a connection when PACER SHARE began, their belief could weaken through time if not reinforced.

The fact that gainshares might have been higher at Sacramento should not be misconstrued. We have found no statistically significant cost savings, and our model inherently accounts for the dependence of unit cost on output. There is also the counterfactual aspect: if adjusted gainshares were higher at Sacramento, what would have happened at other ALCs had they been under gainsharing? We address that in Tables 36 through 38 and Figs. 5 through 7, which we present chiefly for comparison purposes and discuss only briefly. The tables and figures parallel those for Sacramento. For each other ALC we compute gainshares, unadjusted and adjusted, and depict the results. The separate computations employ the intercepts for Ogden, San Antonio, and Warner-Robins, respectively, and the time trend and output effect from the multiple intercept model. The results for Ogden and Warner-Robins are similar to Sacramento's, as one would expect given our hypothesis tests and the fact that they also had a decline in output (Fig. 1). For San Antonio, in contrast, demonstration period output remained at baseline level on average, and the gainshare adjustment makes little difference. *In all cases, the adjusted calculation results in positive gainshares in nearly all quarters.*

SUMMARY

We have studied whether Sacramento achieved labor cost savings under PACER SHARE by June 1990, nearly 30 months into the demonstration. By comparison with the year-one analysis, we were fortunate to have more extensive baseline data and of course more demonstration period data. The added data allowed us to estimate a more general model which fit the data better than our previous models. Data plots also guided our modeling choices. In developing a cost model for other ALCs for the purpose of making comparisons with Sacramento, we selected a specification that reflected the typical behavior of other ALCs—the multiple intercept model—but for completeness we also estimated a single intercept model which, we found, led to the same conclusions.

Using the regression results, we performed a series of hypothesis tests involving Sacramento and other ALCs at baseline and during the demonstration period. We inferred from the results that

Table 36
Ogden Gainshare Pool Adjustment Computation
(including Air Force share)

Demonstration Quarter	Baseline Unit Cost				Gainshare Pool						
	Cost/ Output	Un- adjusted	Adjusted	Adjusted + se	Adjusted - se	Un- adjusted	Adjusted	Adjusted + se	Adjusted - se		
1988											
Winter	439,887	15,967,561	36.73	36.20	39.50	42.70	36.55	(234,854)	1,218,690	2,623,965	(81,442)
Spring	423,938	16,104,546	38.12	36.20	40.46	43.73	37.43	(815,604)	989,858	2,376,904	(293,409)
Summer	471,702	17,364,389	36.91	36.20	37.73	40.78	34.91	(335,405)	386,811	1,826,079	(944,771)
Fall	433,017	16,513,451	38.15	36.20	39.71	42.92	36.74	(846,227)	673,331	2,063,833	(613,135)
1989											
Winter	471,141	16,480,407	35.12	36.20	37.45	40.48	34.65	509,432	1,098,654	2,525,524	(221,458)
Spring	476,193	17,668,466	37.16	36.20	36.97	39.96	34.21	(459,755)	(91,818)	1,331,946	(1,409,056)
Summer	444,463	17,163,627	38.93	36.20	38.95	42.10	36.04	(1,213,107)	11,261	1,411,398	(1,284,118)
Fall	429,269	14,818,070	34.57	36.20	39.76	42.98	36.79	699,576	2,229,991	3,610,399	952,864
1990											
Winter	450,323	15,820,107	35.23	36.20	38.46	41.57	35.58	434,760	1,453,175	2,853,811	157,334
Spring	410,058	16,713,784	40.86	36.20	41.04	44.36	37.97	(1,913,152)	73,056	1,434,087	(1,186,142)

NOTE: All in dollars except output. Values imputed using coefficients:

Baseline intercept	12.2677
Baseline trend	-.0004
Baseline output	.2786
se	.0778

Table 37
San Antonio Gainshare Pool Adjustment Computation
(including Air Force share)

Demonstration Quarter	Baseline Unit Cost				Gainshare Pool						
	Output	Cost	Cost/ Output	Un- adjusted	Adjusted	Adjusted + se	Adjusted - se	Un- adjusted	Adjusted	Adjusted + se	Adjusted - se
1988											
Winter	510,972	15,510,865	30.46	32.77	33.44	36.14	30.93	1,182,469	1,520,392	2,902,031	242,127
Spring	499,619	15,141,792	30.43	32.77	33.96	36.70	31.42	1,173,616	1,764,173	3,136,151	494,845
Summer	473,886	15,406,592	32.63	32.77	35.31	38.17	32.67	68,804	1,270,506	2,623,704	18,554
Fall	499,586	15,310,902	30.64	32.77	33.83	36.57	31.30	1,067,688	1,595,800	2,962,642	331,226
1989											
Winter	577,504	17,782,424	30.84	32.77	30.53	32.99	28.24	1,115,008	(183,291)	1,242,366	(1,502,281)
Spring	597,098	16,953,207	28.40	32.77	29.66	32.06	27.44	2,614,447	753,938	2,186,062	(571,035)
Summer	553,627	16,373,458	29.71	32.77	31.41	33.95	29.06	1,698,829	945,967	2,352,449	(355,282)
Fall	528,813	16,414,611	31.20	32.77	32.42	35.04	29.99	830,340	642,028	2,028,397	(640,613)
1990											
Winter	528,106	16,530,758	31.38	32.77	32.34	34.96	29.92	738,094	510,153	1,891,443	(767,789)
Spring	537,985	16,177,225	30.10	32.77	31.84	34.41	29.45	1,436,701	932,205	2,317,313	(349,271)

NOTE: All in dollars except output. Values imputed using coefficients:

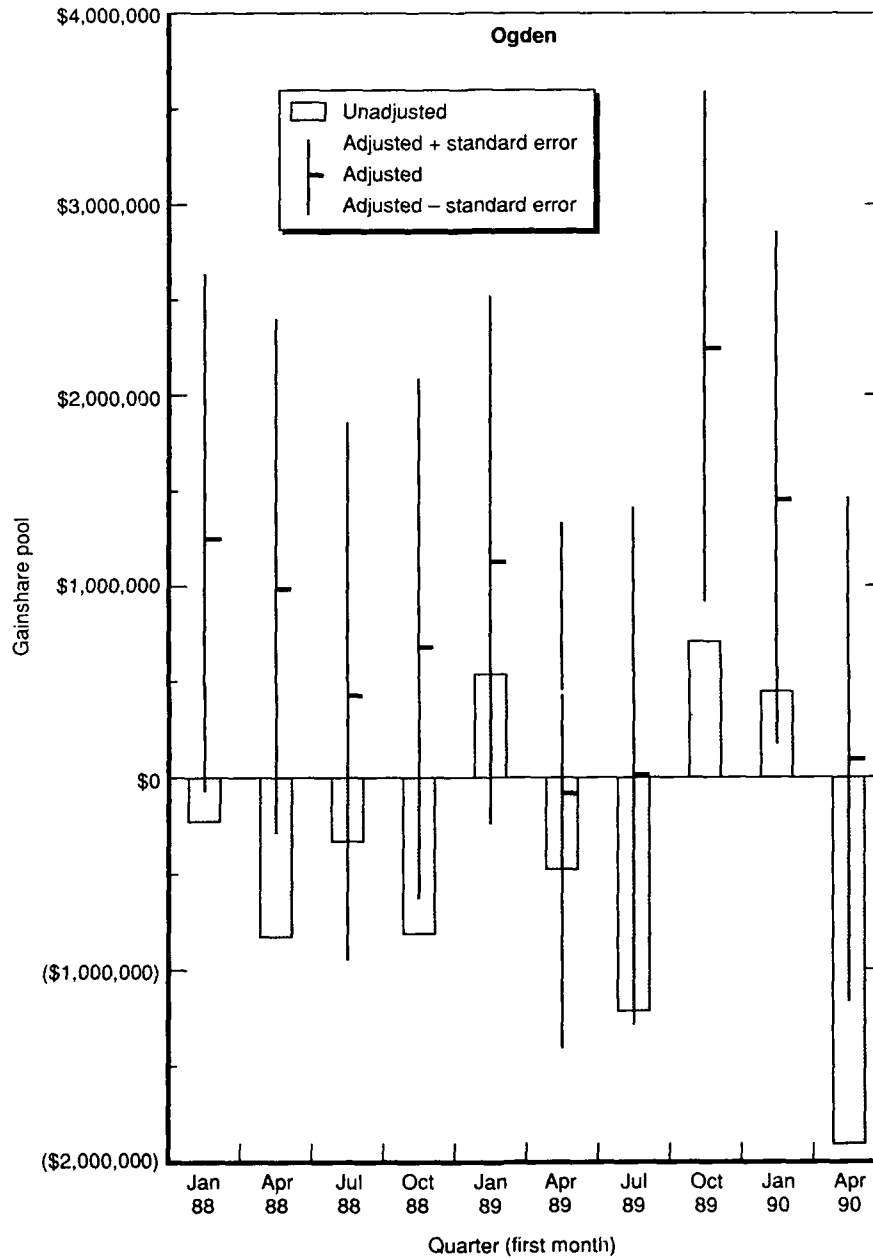
Baseline intercept	12.2110
Baseline trend	-.0004
Baseline output	.2786
se	.0778

Table 38
Warner-Robins Gainshare Pool Adjustment Computation
(including Air Force share)

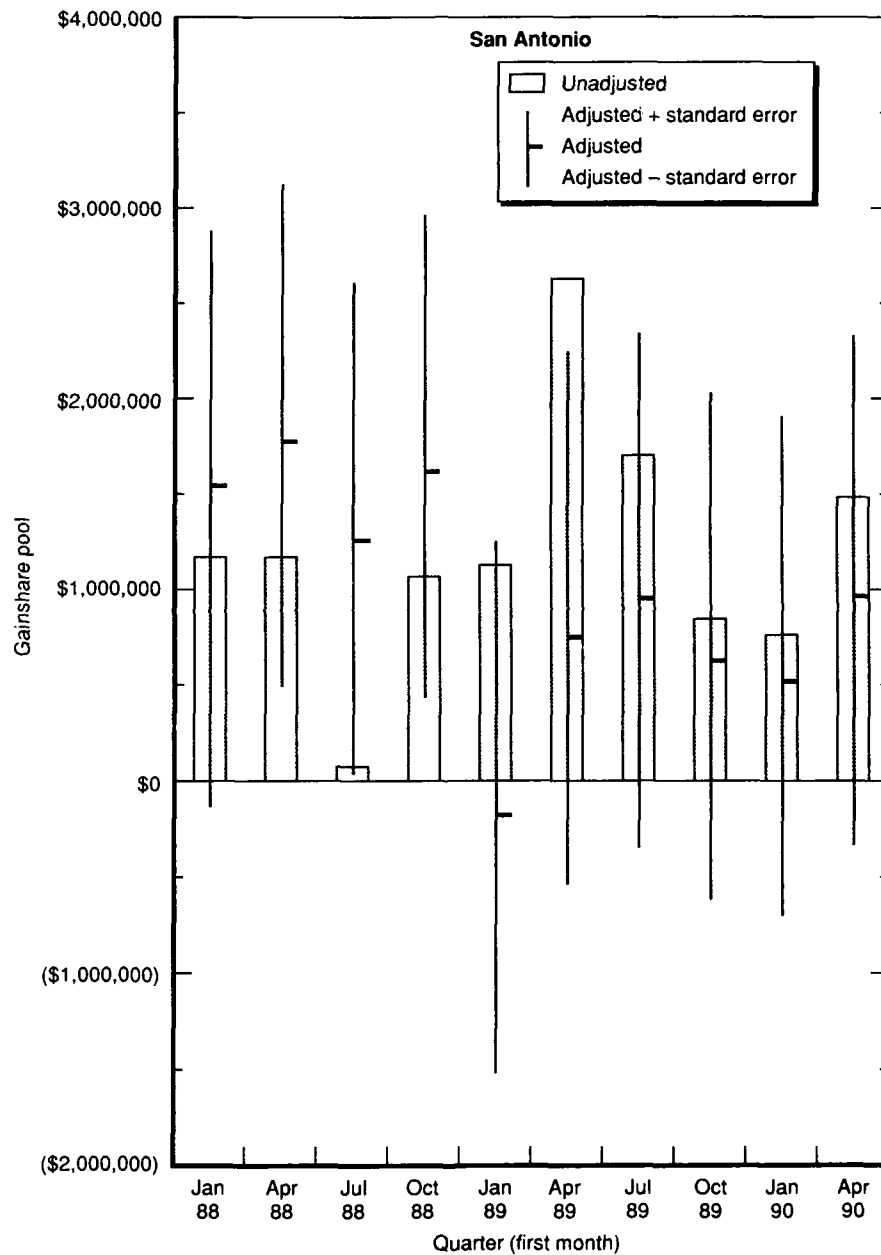
Demonstration Quarter	Baseline Unit Cost				Gainshare Pool						
	Output	Cost	Cost/ Output	Un- adjusted	Adjusted	Adjusted + se	Adjusted - se	Un- adjusted	Adjusted	Adjusted + se	Adjusted - se
1988											
Winter	515,579	16,647,142	32.62	34.43	36.62	39.58	33.88	932,622	2,061,346	3,588,022	648,895
Spring	507,557	17,083,349	33.81	34.43	36.84	39.81	34.08	312,007	1,535,046	3,047,015	136,201
Summer	503,974	16,459,048	32.72	34.43	36.99	39.98	34.22	859,302	2,151,058	3,658,610	756,301
Fall	496,459	16,689,698	33.62	34.43	37.28	40.29	34.49	398,342	1,815,165	3,311,909	430,406
1989											
Winter	540,548	18,097,758	33.60	34.43	35.13	37.97	32.50	446,857	825,878	2,361,440	(594,794)
Spring	537,609	16,992,559	31.58	34.43	35.13	37.97	32.50	1,529,037	1,905,505	3,432,678	492,594
Summer	505,331	17,173,374	34.38	34.43	37.01	40.01	34.24	22,182	1,329,734	2,842,341	(69,701)
Fall	480,985	17,183,793	35.83	34.43	38.08	41.16	35.23	(675,356)	1,080,634	2,561,726	(289,644)
1990											
Winter	542,574	17,025,158	31.39	34.43	34.78	37.59	32.17	1,649,725	1,840,097	3,366,044	428,321
Spring	503,665	16,122,136	32.00	34.43	36.63	39.59	33.89	1,220,224	2,328,188	3,820,016	947,978

NOTE: All in dollars except output. Values imputed using coefficients:

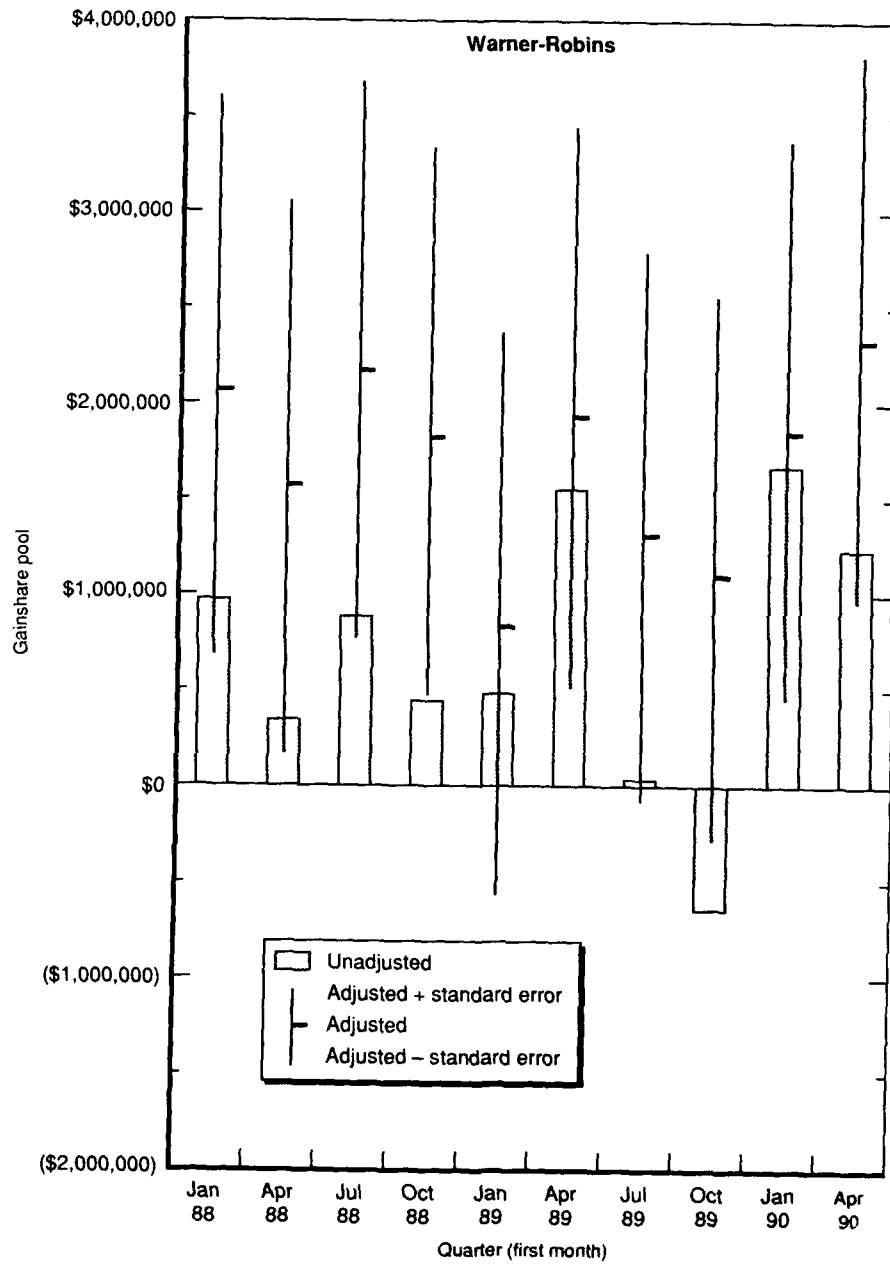
Baseline intercept 12.3041
Baseline trend -.0004
Baseline output .2786
se .0778



**Fig. 5—Ogden Gainshare Pool (Including Air Force Share):
Adjusted vs. Unadjusted**



**Fig. 6—San Antonio Gainshare Pool (Including Air Force Share):
Adjusted vs. Unadjusted**



**Fig. 7—Warner-Robins Gainshare Pool (Including Air Force Share):
Adjusted vs. Unadjusted**

Sacramento's labor cost under PACER SHARE was not statistically different from that at baseline. Although that comparison showed no statistically significant cost savings at Sacramento relative to its baseline, the comparison omitted a key possibility: cost could have increased at other ALCs even though Sacramento's was unchanged, in which case Sacramento might have achieved comparative cost savings. The results, however, did not support that possibility. We found that Sacramento's cost experience did not differ statistically from that of other ALCs. This left us with an apparent paradox. We found no statistically significant cost savings, but Sacramento had paid gainshares in five-of-six consecutive quarters. Our gainshare computations help resolve the paradox. Although Sacramento paid gainshares, the amounts fell within the range expected from its pre-PACER SHARE cost behavior. The same point holds even when we adjust the gainshares for change in output level, an adjustment working in favor of finding cost savings. We therefore conclude that Sacramento displays a tendency toward cost savings under PACER SHARE relative to its baseline, but more, similar evidence must accumulate before the tendency can attain statistical significance. At the same time, a parallel tendency characterizes other ALCs, thereby reducing the prospect for attaining comparative cost savings under PACER SHARE.

7. CONCLUSIONS

The goals of the PACER SHARE Productivity and Personnel Management Demonstration are as follows:

- Increase organizational productivity by improving incentives and training that will help employees work more effectively and encourage them to originate ideas on improving efficiency.
- Increase organizational flexibility in making job assignments and dealing with fluctuations in workload.
- Enrich the quality of work life by creating a work environment in which individual and organizational goals are compatible, opportunities for individuals to work on a variety of jobs are realized, and training opportunities are expanded.
- Preserve or improve the quality and timeliness of work through quality circles, team building, and statistical process control.

Are these goals being achieved? In this section, we briefly review the findings of our evaluation through the second year of the demonstration.

PRODUCTIVITY

Our analysis reveals no statistically significant cost savings when Sacramento's experience during the demonstration period is compared with its baseline experience, or when Sacramento's overall experience is compared with that of other ALCs. Although finding no significant cost savings, we discovered that PACER SHARE's gainsharing formula underestimated what unit cost would have been in view of Sacramento's lower workload during the demonstration period, and hence has underestimated cost savings for gainshare computation. Had an adjustment been made, larger gainshares would have been available to strengthen the feedback effect of those payments on productivity. Our approach could contribute toward modifying the gainshare formula to adjust for changes in output level. In any event, the actual payment of gainshares plus the possibility such payments could have been higher, sustains the *prospect* of statistically significant cost savings relative to Sacramento's baseline. Yet because other ALCs also have a tendency for cost savings relative

to their baseline, it remains to be seen whether Sacramento can attain cost savings compared with them.

ORGANIZATIONAL FLEXIBILITY

The demonstration's success at promoting organizational flexibility and quality of work life was measured through an employee attitude survey and personnel system data. Although we separate the survey and personnel system measures here according to which goal they seem most clearly associated with, it should be kept in mind that organizational flexibility and quality of work life are related. For example, increases in earning potential brought about through pay banding (organizational flexibility) can improve the perceived quality of work life. For that matter, generally speaking the four goals are interrelated, so many of our measures have implications for more than one goal.

Measures related to organizational flexibility generally exhibited encouraging results, although the pattern was not universal. Our emphasis is on the change at Sacramento during the first two years of the demonstration *relative* to the change in DS at the four other ALCs combined. As intended, the incidence of multiple skill training increased at Sacramento relative to the comparison sites. Also as intended, earnings increased for nonsupervisory employees without an increase in the overall wage bill. At the same time, there was no evidence of pay inversion between supervisory and nonsupervisory positions. Crossovers from white- to blue-collar positions did not increase, although higher blue- to white-collar changes were found due to a reclassification action. In the main, however, crossovers remained infrequent. Moreover, the percentage of career employees increased at Sacramento relative to the comparison sites, as the total work force was decreasing in size.¹ Supervisors' perceptions of support from the Personnel Office, the fairness of their grading criteria, and staffing flexibility improved, as did work force perceptions of training opportunities, job competition fairness, and gainsharing of organizational cost savings. On the negative side, the percentage of supervisors within DS and their distribution across divisions remained the same. Although this indicates that supervisory positions were not proliferated, it also suggests that the flexibility sought through changes in supervisory grading criteria had not yet been fully realized. Also, attitudes toward pay and promotion under revised base pay

¹This was partly attributable to holding off on hiring as positions were vacated by attrition.

determination worsened. Changes in other attitudes related to flexibility—blue- versus white-collar pay equity, staffing needs, job classification satisfaction, and career opportunities—were not significantly different from those at the comparison ALCs.

QUALITY OF WORK LIFE

Individual survey questions assessing quality of work life were grouped into broadly based scales, which in turn were classified into several broad dimensions (through factor analytic methods). The dimensions and scales are reviewed in Table 39.

Measures of satisfaction with supervision and co-worker interactions (the first area), overall work satisfaction (the second area), and miscellaneous work environment perceptions (the last area) showed substantial improvement at Sacramento during the first two years of PACER SHARE. Eight of the scales showed differential change, and another (reconsideration/redress) showed marginal significance. Only job satisfaction, intent to turn over, and organizational climate showed changes similar to those at the comparison sites. However, the pattern was quite different in those areas concerned with pay. General pay satisfaction and satisfaction with the link between performance and advancement worsened (became significantly more negative) at Sacramento during the first two years of PACER SHARE relative to the comparison sites. We attribute the former result in part to a greater increase in the cost of living in the Sacramento area as compared with the areas surrounding the other ALCs. However, some overall pay dissatisfaction and dissatisfaction with the link between performance and advancement appear attributable to concerns about salary advancement through the pay bands and about promotions under PACER SHARE.

The pattern of results was even stronger when a statistical control for the perceived link between pay and performance was provided. When we look at the nonfinancial aspects of these scales, we find that every scale in the satisfaction with supervision and co-worker interactions, overall work satisfaction, and miscellaneous work environment perception areas improved substantially and significantly at Sacramento relative to the change at the comparison sites. These findings not only suggest improvement in nonfinancial aspects of quality of work life, but raise the hypothesis that to the extent gainshares can be paid and concerns about advancement through the pay bands addressed in year three, we may observe the larger pattern of change in the full, unadjusted attitude results.

Table 39
Major Survey Areas

SATISFACTION WITH SUPERVISION AND CO-WORKER INTERACTIONS

General supervision and direction, group functioning, open group process, satisfaction with supervision and work unit

OVERALL WORK SATISFACTION

Intrinsic work satisfaction, job satisfaction, intent to turn over

GENERAL PAY SATISFACTION

External equity, pay satisfaction

REWARD SYSTEM SATISFACTION

Pay as a motivator, pay-performance link, promotion satisfaction

MISCELLANEOUS WORK ENVIRONMENT PERCEPTIONS

Organizational climate, control over work, reconsideration and redress, training opportunities, organizational involvement

Finally, to the extent that PACER SHARE achieves its goal of improving the quality of work life, we would expect turnover to decrease. At baseline, total turnover was nearly 15 percent at Sacramento—significantly higher than for the comparison group—representing separations of nearly 11 percent and internal transfers (migration) to other directorates of just under 4 percent, both significantly higher than for the comparison ALCs. During year two of PACER SHARE, as compared with the other ALCs, Sacramento showed declines in turnover. Separations decreased comparably at Sacramento and the other ALCs, whereas the decline in internal transfers and total turnover was significantly greater at Sacramento. As a result, the year-two turnover rates were similar for Sacramento and the comparison ALCs. Since Sacramento had greater turnover at baseline (and previously), the change is consistent with an improvement in quality of work life.

WORK QUALITY AND TIMELINESS

Work quality began at a superior level at Sacramento, and for error rates it showed little change throughout year two of the demonstration. Of eight error rate measures, three showed improvement at Sacramento during the second year of PACER SHARE, three showed no change, and two worsened. In contrast, measures concerning receiving timeliness and shipping support deteriorated at Sacramento relative to the comparison group. This may be at least partially at-

tributable to the implementation of the Automated Warehouse System at Sacramento and to support for the F-15 program.

A number of attitude questions relevant to the foregoing discussion were added to the survey at year one. The year-two results show significant increases in perceived information exchange in accomplishing work, usefulness of quality circle participation, and emphasis on team-building concepts in day-to-day operations. Many of the changes—especially those for team building—were large and highly significant. The changes are consistent both with better work quality and improved quality of work life.

A FINAL NOTE

Although the changes in federal civil service practices required to implement PACER SHARE were in place at its outset, it must be recognized that true implementation must unfold over time. For example, DS employees will have to be provided training to take advantage of increased personnel system flexibility in meeting changing workloads, DOC hires will have to occur over time as the need arises, and so forth. As a result, in future evaluations a broader range of measures will become available for analysis and current measures will become more meaningful. It is important to wait for these additional measures and to observe the longer-term results of PACER SHARE before drawing firm conclusions concerning its effectiveness. Nonetheless, although the year-two results do not provide evidence of significant cost savings, they offer encouragement that PACER SHARE may be beginning to achieve its desired objectives in other areas.

Appendix A

PACER SHARE VS. OTHER OPM DEMONSTRATION PROJECTS

PACER SHARE is one of several demonstration projects being conducted under the authority of Title VI of the Civil Service Reform Act. These projects test innovations in public personnel management by permitting waivers of current laws and regulations, such as those designed to improve productivity and employee performance by making the federal personnel system more flexible and responsive. Three of those demonstrations began before PACER SHARE:

- Integrated Approach to Pay, Performance Appraisal, and Position Classification for More Effective Operation of Government Organizations (Department of the Navy)
- Alternative Personnel Management System (National Institute of Standards and Technology)
- Airway Science Curriculum (Federal Aviation Administration)

The first of these demonstrations is being conducted at the Naval Ocean Systems Center in San Diego and the Naval Weapons Center at China Lake. Its purpose is to demonstrate whether the effectiveness of federal laboratories can be enhanced by allowing management greater control over personnel functions and expanding the opportunities available to employees. Like PACER SHARE, the project examines the benefits of a simplified classification system and pay banding. However, it does not emphasize organizational productivity, it retains performance ratings, and it provides merit pay to reward individual performance rather than gainsharing to reward collective performance. Also, its participants are largely white collar.

The demonstration by the National Institute of Standards and Technology has much in common with the Navy project. Its goals are to simplify the classification process, make it more understandable, and place more decisionmaking authority with line managers. It establishes pay banding and links salaries to individual performance. It differs from the Navy demonstration by testing such innovations as sabbaticals and compensation comparability with the private sector. Participants are primarily scientists and engineers.

The FAA demonstration was intended to develop alternative qualifications and recruitment sources primarily for agency technical occupations. It thus had little in common with PACER SHARE. It was conducted between 1987 and 1991.

Since PACER SHARE began, OPM has approved two more demonstration projects. One is another FAA demonstration, this one testing retention allowances covering difficult-to-staff positions at air traffic control facilities in the Chicago, Los Angeles, New York, and Oakland areas. The other is a test of skill-based pay by the Defense Logistics Agency at its Ogden, Utah, depot. A third personnel management demonstration was legislated by Congress. It provides lump-sum relocation bonuses and retention allowances to alleviate severe recruitment and retention problems at the FBI in New York City.

Appendix B

RESULTS FOR THE SINGLE-INTERCEPT MODEL

This appendix, a companion to the cost savings analysis in Sec. 6, presents regression results, hypothesis tests, and gainsharing computations based on the pooled-data, single-intercept model. Even though specific estimates differ, that model leads to the same conclusion as the multiple-intercept model described in the text—no statistically significant PACER SHARE cost savings (despite the payment of gainshares at Sacramento).

Table B.1 contains labor cost regressions for Sacramento, all other ALCs, and other ALCs excluding Oklahoma City. Relative to results for single ALCs (Table 31), the results inclusive of Oklahoma City are implausible, so Oklahoma City was dropped from further analysis. (Note the high intercept and low output effect at baseline, the high time trend in the demonstration period, and the low R-square.) The results for pooled data including only Ogden, San Antonio, and Warner-Robins agree fairly well with the separate ALC regressions, although some differences occur. The pooled-data intercept is low at baseline and high in the demonstration period, whereas the output effect is high at baseline and low in the demonstration. These differences result from the data pooling; the ALCs tend to have different ranges of output but similar ranges of cost, and when the data are pooled the overall cluster of points has a different shape than that of the individual ALC clusters. That causes the low intercept and high output effect at baseline and, because the level of output decreases and its overall range across ALCs broadens, the high intercept and low output effect in the demonstration period; see Fig. 2, Sec. 6, for the cluster patterns. It is because of these intercept and output effect differences that we prefer the multiple-intercept model of Sec. 6.

Table B.1 reveals change at Sacramento and other ALCs from baseline to the demonstration period. For each, the intercept rose and the output effect became smaller. Sacramento's intercept changed from 11.28 to 13.81 compared with 10.93 to 13.16 for other ALCs; Sacramento's output effect fell from .36 to .14 versus a drop of .39 to .19 for other ALCs. There was some divergence in time trend, however. Sacramento's trend fell from $-.0019$ to $-.0026$, whereas other ALCs' trend rose from $-.0004$ to $.0007$. In contrast to these changes from period to period, Sacramento and other ALCs have similar coef-

Table B.1
Labor Cost Regressions: Sacramento vs. Comparison Group
(dependent variable: \ln labor cost)

Variable	Sacramento	All Other ALCs	All Other ALCs Except Oklahoma City
BASELINE PERIOD			
Intercept	11.28 (2.86)	14.60 (.95)	10.93 (1.06)
Time	-.0019 (.0014)	-.0002 (.0006)	-.0004 (.0006)
\ln output	.36 (.24)	.08 (.08)	.39 (.09)
DEMONSTRATION PERIOD			
Intercept	13.81 (2.69)	12.29 (.82)	13.16 (.88)
Time	-.0026 (.0019)	.0029 (.0009)	.0007 (.0010)
\ln output	.14 (.23)	.26 (.07)	.19 (.07)
Adj. R-square	.77	.18	.31
Standard error of estimate	.06	.09	.08

NOTE: Standard errors are in parentheses.

ficients within a period, although again with some difference in time trend. During the baseline period, the intercepts are 11.28 versus 10.93 and the output effects are .36 versus .39 for Sacramento and other ALCs, respectively. Sacramento has a more pronounced trend, -.0019, nearly five times the other ALCs' trend of -.0004. During the demonstration period the intercepts are 13.81 and 13.16, the output effects .14 and .19, and time trends -.0026 and .0007. Finally, although Sacramento's and other ALCs' coefficients changed between the baseline and demonstration periods, since Sacramento's coefficients tend to lie within a standard error of the other ALCs' coefficients in each period, we will be unlikely to find relative cost reduction at Sacramento. The hypothesis tests reported next bear this out.

RESULTS OF HYPOTHESES TESTS

Hypothesis test results are shown in Table B.2. (See Sec. 6 for information on interpreting table entries.) The results are consistent with the following statements: (1) Sacramento's intercept, time trend, and

Table B.2
Hypothesis Test Results

H1 hypotheses: Sacramento versus other ALCs during baseline period.				
	\ln Cost	Intercept	Time Trend	\ln Output
Equal?	Reject	Accept	Accept	Accept
Probability	.0039	.90	.28	.89
H2 hypotheses: Other ALCs, demonstration versus baseline periods.				
	\ln Cost	Intercept	Time Trend	\ln Output
Equal?	Reject	Reject	Accept	Reject
Probability	.0014	.10	.36	.09
H3 hypotheses: Sacramento, demonstration versus baseline periods.				
	\ln Cost	Intercept	Time Trend	\ln Output
Equal?	Accept	Accept	Accept	Accept
Probability	.27	.48	.71	.47
H4 hypotheses: Sacramento versus other ALCs during demonstration period.				
	\ln Cost	Intercept	Time Trend	\ln Output
Equal?	Reject	Accept	Reject	Accept
Probability	.0001	.80	.09	.80
H5 hypotheses: Change at Sacramento, demonstration versus baseline periods, versus change at other ALCs, demonstration versus baseline periods.				
	\ln Cost	Intercept	Time Trend	\ln Output
Equal?	Accept	Accept	Accept	Accept
Probability	.80	.94	.44	.94

output effect, when taken individually, are the same as other ALCs' at baseline. However, when the coefficients are viewed as a group, Sacramento differs statistically from other ALCs. This occurs because the sets of coefficients are more precisely measured than are single coefficients. Still, the results suggest that Sacramento and the other ALCs are comparable at baseline, providing a reasonable foundation for the further hypothesis tests. (2) Other ALCs' cost differs between the baseline and demonstration periods. The factors driving this difference are the change in intercept and output coefficients. As we saw, the demonstration period intercept is larger than at baseline and the output effect is smaller. The gainsharing computations below imply that, controlling for output level, labor cost fell from baseline to demonstration period. (3) Sacramento's intercept and output effect change the same way between the baseline and demonstration periods but labor cost does not differ significantly. While true based on our test, the result reflects the smaller precision of Sacramento's estimates due to its smaller sample size than the other ALCs' pooled-

data sample. Yet as stated above, Sacramento's intercept and output effects change by virtually the same amount as those of other ALCs. (If we could draw upon other ALCs' pattern in judging Sacramento's change rather than keeping it apart as a contrast, we might well conclude that Sacramento's change was statistically significant too.) And as true for the other ALCs, the gainsharing computations for Sacramento indicate cost improvement over baseline. (4) Sacramento's cost differs from other ALCs' cost in the demonstration period, a result driven by the difference in time trend. (5) The change in Sacramento's cost from baseline to the demonstration period is the same as the change in other ALCs' cost. Overall, while there are some differences from the multiple-intercept model results, the main conclusion remains the same. Relative to its own past performance and the performance of other ALCs, Sacramento has not attained statistically significant cost savings under PACER SHARE.

GAINSHARING

The reader is referred to Sec. 6 for discussion of the gainsharing formula and the adjustment we make to unit cost. Here we focus on ALCs other than Sacramento. Sacramento's gainsharing computations do not differ from those reported in Sec. 6 because its model has not changed. But other ALCs' gainshares change because now they are based on a single-intercept model rather than the multiple-intercept model. In the following we first test for independence of unit labor cost from output and then present gainshare computations that are both unadjusted and adjusted for output level. We found before that the adjustment results in higher gainshares at both Sacramento and other ALCs. We find the same result for other ALCs now.

As before, the test rejects independence of other ALCs' unit cost from output (Table B.3). The regression results for Sacramento and the other ALCs both imply that a 1 percent increase in output is associated with a .6 percent drop in the unit cost in baseline period and a .8 percent drop during the demonstration period. The tests are highly significant in all cases.

Table B.4 and Fig. B.1 show how the dependence of unit cost on output affects the gainshare computation for the other ALCs. The tables are constructed with "would have" unit cost equal to average baseline unit cost and, alternatively, adjusted baseline unit cost. (The figures are illustrative, not official.) Briefly, $\text{gainshare} = (\text{"would have" unit cost} - \text{current unit cost}) \times \text{current output}$. In addition, we present adjusted "would have" unit costs for a standard error above and below

Table B.3
Tests for Independence of Unit Cost from Output

Site	$a_2 - 1$	t-value	Reject Independence ($a_2 - 1) = 0?$
BASELINE			
Sacramento	-.64 (.23)	-2.8	yes
Other ALCs	-.61 (.09)	-6.8	yes
DEMONSTRATION			
Sacramento	-.86 (.24)	-3.6	yes
Other ALCs	-.81 (.07)	-11.6	yes

NOTE: All t-values exceed the .01 significance level of 2.4. Estimates of a_2 come from Table B.1 for other ALCs and Table 31 for Sacramento. Standard errors are in parentheses.

the regression prediction, and show the associated gainshare computation for these values. As in Sec. 6, the adjusted gainshares exceed the unadjusted, providing further support for the findings and conclusions drawn there.

GAINSHARE PAYMENTS AT SACRAMENTO

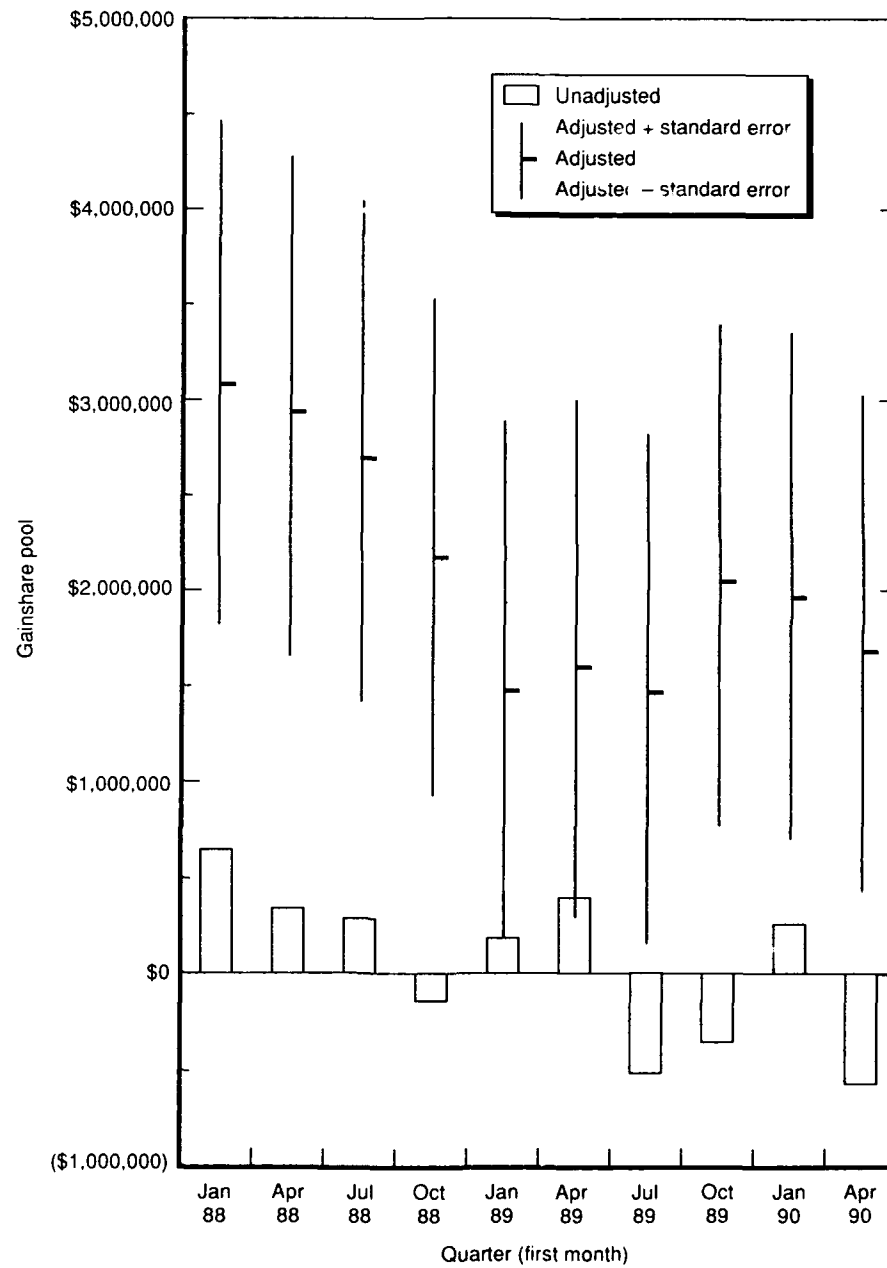
Table B.5 shows the unit cost savings and associated gainshares declared by Sacramento since the initiation of the demonstration.

Table B.4
Other ALCs' Gainshare Pool Adjustment Computation
(including Air Force share, single-intercept model)

Demonstration Quarter	Mean Output	Mean Cost	Mean Cost/ Output	Baseline Unit Cost				Gainshare Pool			
				Un- adjusted	Adjusted	Adjusted + se	Adjusted - se	Un- adjusted	Adjusted	Adjusted + se	Adjusted - se
1988											
Winter	499,427.8	20,779,837.3	31.67	32.96	37.85	40.59	35.29	642,361	3,083,547	4,454,085	1,805,666
Spring	489,864.0	20,839,677.3	32.30	32.96	38.24	41.01	35.65	324,842	2,910,889	4,269,075	1,644,525
Summer	499,177.0	21,393,209.7	32.37	32.96	37.76	40.50	35.21	293,434	2,689,481	4,056,147	1,415,210
Fall	498,737.3	21,955,939.0	33.27	32.96	37.61	40.34	35.07	(156,951)	2,162,296	3,522,343	894,198
1989											
Winter	544,261.0	23,540,387.0	32.64	32.96	35.34	37.91	32.96	175,154	1,473,550	2,868,368	173,029
Spring	546,197.0	23,293,758.0	32.24	32.96	35.14	37.69	32.77	392,025	1,584,834	2,976,623	287,138
Summer	516,788.8	23,029,838.0	33.96	32.96	36.73	39.40	34.25	(517,097)	1,433,749	2,810,223	150,334
Fall	494,129.3	22,045,996.0	33.69	32.96	37.78	40.52	35.23	(358,889)	2,025,081	3,378,808	762,874
1990											
Winter	521,652.8	22,479,902.7	32.49	32.96	36.24	38.87	33.79	244,452	1,958,344	3,329,260	680,110
Spring	496,052.8	22,302,027.7	34.14	32.96	37.50	40.21	34.96	(586,073)	1,664,046	3,012,664	406,602

NOTE: All in dollars except output. Values imputed using coefficients:

Baseline intercept	12.3000
Baseline trend	-.0004
Baseline output	.2786
se	.0778



**Fig. B.1—Other ALCs' Gainshare Pool (Including Air Force Share):
Unadjusted vs. Adjusted via Single-Intercept Model**

Table B.5
Gainshare Payments by Sacramento

Quarter and CY	Unit Cost Savings	Employee Gainshare
1 qtr CY88	0	0
2 qtr	0	0
3 qtr	0	\$128.09 ^a
4 qtr	0	0
1 qtr CY89	\$527,018	\$163.64
2 qtr	\$1,003,614	\$312.31
3 qtr	\$84,694	\$26.57
4 qtr	0	0
1 qtr CY90	\$187,352	\$59.49
2 qtr	\$312,501	\$102.08

^aPerformance Award.

Appendix C

LABOR COST AND OUTPUT DATA BY ALC

This appendix lists the data used in the year-two analysis of cost savings. The labor cost data are for paid labor, including straight-time hours of work and overtime, as well as paid time away from work such as sick leave and vacation. The labor cost data (Table C.1) have been inflated/deflated to 1989 dollars; the factor for each month is also listed. These constant-dollar labor costs were used in the empirical analysis. The output data (Table C.2) indicate the total number of issues and receipts, including receipts from off base, on-base receipts from maintenance, on-base receipts not from maintenance, issues off base, on-base issues to maintenance, on-base issues not to maintenance, and on-base issues to disposal.

Table C.1
Labor Cost Data, \$

Date	Oklahoma City	Ogden	San Antonio	Sacramento	Warner- Robins	Inflator
Oct-84	5244860	7029433	5661520	5713648	6723636	1.2070
Nov-84	5533141	6885598	5026940	5535273	6341749	1.2060
Dec-84	5199018	6261187	5382266	5216358	6187527	1.2050
Jan-85	5419407	7155645	5875764	5975360	6833616	1.2040
Feb-85	4578549	6341882	5048219	5100813	6027830	1.2030
Mar-85	5298545	6406640	5325799	5320845	6322820	1.2020
Apr-85	5535439	5602601	5648382	5459784	6516264	1.2010
May-85	5839536	5888023	5865889	5849814	6798622	1.2000
Jun-85	5210097	5268121	5391965	5050946	5877516	1.1990
Jul-85	5205752	5920013	5994162	5870632	6864724	1.1980
Aug-85	6352618	5861970	5864320	5721519	6546292	1.1970
Sep-85	5039336	5501429	5847881	5639487	6252255	1.1960
Oct-85	5743991	5327348	5778382	6030701	7010375	1.1950
Nov-85	5346757	5556477	5845389	5710500	6448094	1.1940
Dec-85	5499791	5102608	6437309	5878821	6806948	1.1930
Jan-86	5394951	5533027	6410201	6191439	7463399	1.1920
Feb-86	5656453	4834580	5560711	5376796	5850268	1.1910
Mar-86	5541549	5038788	5978151		6378870	1.1900
Apr-86	5267064	7621380	6097311	5952227	6658018	1.1849
May-86	5743941	7810091	5941970	5923174	6740416	1.1798
Jun-86	5624078	5944605	5818595	5588127	6543279	1.1748
Jul-86	5866395	6427723	6190608	6050263	6765993	1.1697
Aug-86	5753537	6065523	5870730	5267615	6604762	1.1646
Sep-86	6210767	7092318	6058399	5723197	6820819	1.1595
Oct-86	6215824	6625067	6090018	5845139	6951956	1.1544
Nov-86	5919390	5307166	5311875	5263425	5968173	1.1493
Dec-86	5925348	5982901	6178417	5532027	6560552	1.1443
Jan-87	5850483	6207345	6084184	5674308	6791546	1.1392
Feb-87	5366406	6449998	5486204	5064245	5885022	1.1341
Mar-87	5876587	6372770	6015959	5450651	6308071	1.1290
Apr-87	5688664	6499864	5866206		6694918	1.1212
May-87	5796076	6189834	5458890	4944680	6242759	1.1133
Jun-87	5254845	5644357	5854667	5367419	6308483	1.1055
Jul-87	5703137	6784775	5989212	5326850	6469377	1.0977
Aug-87	5143135	6171845	5479589	4804077	5978369	1.0898
Sep-87	5038226	6940080	5945771	5349091	6374351	1.0820
Oct-87	5269141	5368642	5636967	5099681	5871287	1.0742

Table C.1—continued

Date	Oklahoma City	Ogden	San Antonio	Sacramento	Warner- Robins	Inflator
Nov-87	4664314	5069099	5487315	4588790	5764885	1.0663
Dec-87	5465535	4657181	5803540	5141635	6308487	1.0585
Jan-88	4447451	6048297	5414078	4734639	5733206	1.0507
Feb-88	4629715	5123228	4732771	4536616	5339799	1.0428
Mar-88	5136778	4796036	5364016	4921734	5574137	1.0350
Apr-88	5113896	4551735	4977614	4312676	5238557	1.0321
May-88	4255265	6452257	5055607	4630146	6221299	1.0292
Jun-88	4820184	5100554	5108571	4810555	5623493	1.0263
Jul-88	4387240	4896703	4869956	4453182	5325920	1.0233
Aug-88	5835813	6239153	5311183	4850413	5486684	1.0204
Sep-88	4726547	6228533	5225453	4855541	5646444	1.0175
Oct-88	5684011	5956193	5224611	4611890	5330494	1.0146
Nov-88	5760061	5181735	4793663	4591943	5563710	1.0117
Dec-88	5909694	5375523	5292628	4589189	5795494	1.0088
Jan-89	6058367	5558274	5879274	4530881	6188665	1.0058
Feb-89	5351256	5202021	5541660	4219697	5311141	1.0029
Mar-89	6850949	5720112	6361490	4861290	6597952	1.0000
Apr-89	5725277	5548740	5296000	4125238	5226815	0.9971
May-89	6397665	6077767	5980661	4505136	6032235	0.9942
Jun-89	6144100	6041959	5676546	4718052	5733509	0.9913
Jul-89	5902236	5887794	5268305	4031667	5673460	0.9883
Aug-89	6352834	5637906	5686543	4561741	5993545	0.9854
Sep-89	6123985	5637927	5418610	4132758	5506369	0.9825
Oct-89	6009784	4893342	5494079	4083274	5692055	0.9796
Nov-89	5985122	5005882	5616294	4445733	6106716	0.9767
Dec-89	5726608	4918846	5304238	4435230	5385022	0.9738
Jan-90	6198821	5423976	5880011	4582994	5962567	0.9708
Feb-90	5772377	4938735	5082882	4173104	5130167	0.9679
Mar-90	6092487	5457396	5567865	4375011	5932424	0.9650
Apr-90	5926099	5454026	5444690	4449658	5283836	0.9621
May-90	6259806	5756368	5327673	4758615	5726832	0.9592
Jun-90	5707033	5503390	5404862	4187181	5111468	0.9563

Table C.2
Output Data: Issues and Receipts

Date	Oklahoma City	Ogden	San Antonio	Sacramento	Warner- Robins
Oct-84	189539	173156	180579	176157	196547
Nov-84	181642	172683	162343	157354	182155
Dec-84	163396	155024	155481	151960	179442
Jan-85	189386	170798	156780	163575	194008
Feb-85	180063	159354	158043	159796	186101
Mar-85	227940	177137	187852	172913	213005
Apr-85	200467	181335	191274	172440	207790
May-85	209955	179540	180511	166943	207658
Jun-85	190665	144648	160946	156359	176135
Jul-85	202900	157313	178005	164842	182299
Aug-85	216464	141557	181202	169618	204432
Sep-85	194839	182033	164999	156897	184359
Oct-85	205359	192337	191417	165766	205814
Nov-85	193661	173590	175067	151966	183958
Dec-85	193670	171793	168593	149736	181753
Jan-86	201055	183950	174727	156724	189047
Feb-86	188481	168557	205647	147480	182485
Mar-86	207833	187154	190502	185279	190652
Apr-86	205062	193246	189650	185914	188183
May-86	188697	164767	167986	162619	186008
Jun-86	190865	171506	168657	169238	175110
Jul-86	202900	178613	177630	167895	183019
Aug-86	216464	156231	179067	162920	191482
Sep-86	195109	186227	175027	157792	188351
Oct-86	201202	162600	189471	170381	187890
Nov-86	184674	152795	165297	151202	168354
Dec-86	185815	157778	164798	155022	168685
Jan-87	173668	155106	170231	151373	170670
Feb-87	185385	170812	169569	159666	180581
Mar-87	219388	191469	191485	181899	211191
Apr-87	211823	177990	191778	169348	203129
May-87	178203	156354	182334	156223	192059
Jun-87	193533	166239	184045	155453	186882
Jul-87	186806	168517	186833	157572	179566
Aug-87	192555	157335	181490	156230	182901
Sep-87	203842	165798	185649	150811	192426

Table C.2—continued

Date	Oklahoma City	Ogden	San Antonio	Sacramento	Warner- Robins
Oct-87	198503	161152	191638	154393	192099
Nov-87	175003	153074	163139	140744	186152
Dec-87	171594	146166	168732	134379	173587
Jan-88	153500	136468	158926	134638	153559
Feb-88	184626	140821	172694	137272	167961
Mar-88	193147	162598	179352	148318	194059
Apr-88	184451	149607	177723	134998	180907
May-88	169868	143975	167425	130126	167354
Jun-88	174023	130356	154471	125972	159296
Jul-88	170780	130510	140624	118811	155016
Aug-88	195203	163583	170520	145740	173938
Sep-88	181163	177609	162742	124665	175020
Oct-88	193292	150311	168609	135182	163687
Nov-88	185059	146430	158963	118002	168847
Dec-88	187536	136276	172014	125429	163925
Jan-89	197825	162090	185537	136427	198965
Feb-89	180893	139019	178623	131744	169957
Mar-89	209133	170032	213344	149125	171626
Apr-89	189480	162513	197575	139455	173530
May-89	196483	161948	197410	150743	185493
Jun-89	187925	151732	202113	133475	178586
Jul-89	168171	136212	172633	126966	147455
Aug-89	213041	165474	206687	148025	197321
Sep-89	182522	142777	174307	131665	160555
Oct-89	193619	146134	194768	134527	172599
Nov-89	184390	147965	173174	131639	163303
Dec-89	159441	135170	160871	115089	145083
Jan-90	188001	145957	169402	132488	175984
Feb-90	178877	138897	169325	118090	177151
Mar-90	198730	165469	189379	136699	189439
Apr-90	176313	140471	173609	126365	167895
May-90	183509	143565	186320	127627	168855
Jun-90	172681	126022	178056	119828	166915

BIBLIOGRAPHY

- Alchian, Armen, and Harold Demsetz, "Production, Information Costs and Economic Organization," *American Economic Review*, Vol. 62, No. 5, December 1972, pp. 777-795.
- Ash, R. A., E. L. Levine, and F. Sistunk, "The Role of Jobs and Job Based Methods in Personnel and Human Resources Management," *Research in Personnel and Human Resources Management*, Vol. 2, 1984, p. 261.
- Beer, Michael, and Bert Spector, "Human Resources Management: The Intergration of Industrial Relations and Organizational Development," *Research in Personnel and Human Resources Management*, Vol. 2, 1984.
- Bradley, Keith, and Stephen Hill, "Quality Circles and Managerial Interests," *Industrial Relations*, Vol. 26, No. 1, Winter 1987, pp. 68-82.
- Chisholm, Rupert, "Quality of Working Life: Critical Issues for the 80s," *Public Productivity Review*, Vol. 7, No. 1, March 1983, pp. 10-25.
- Davis, Louis E., "Job Satisfaction Research: The Post Industrial Era," *Industrial Relations*, Vol. 10, May 1971, pp. 176-193.
- Deming, W. E., *Out of the Crisis*, MIT Press, Cambridge, Mass., 1987.
- Federal Register*, Vol. 45, No. 77, p. 26504, April 18, 1980. Notice: OPM approves demonstration project to experiment with new and different personnel management concepts.
- Federal Register*, Vol. 48, No. 15, p. 2725, January 21, 1983. *Code of Federal Regulations*, Title 5, Part 470. Rule: OPM to conduct personnel management research and demonstration projects under PL 95-454 provisions.
- Federal Register*, Vol. 48, No. 137, p. 32490, July 15, 1983. Notice: OPM approves final demonstration project plan for a proposed Airway Science Curriculum, a new personnel management concept.
- Federal Register*, Vol. 52, No. 191, pp. 37082-37096, October 2, 1987. Notice: OPM approves joint personnel management demonstration project with NBS regarding alternative personnel management system at NBS.

- Federal Register*, Vol. 52, No. 224, pp. 44782-44810, November 20, 1987. Part III: Office of Personnel Management (Proposed Demonstration Project; PACER SHARE: A Federal Productivity Enhancement Program; Notice of Final Approval).
- Frost, Carl, "The Scanlon Plan at Herman Miller, Inc.: Managing and Organization by Innovation," in Robert Zager and Michael P. Rosow (eds.), *The Innovative Organization: Productivity Programs in Action*, Pergamon Press, New York, 1982.
- General Accounting Office, *Gainsharing: DOD Efforts Highlight an Effective Tool for Enhancing Federal Productivity* (Briefing report), Report No. GAO/GGD-86-143BR, B-224117, September 1986.
- Gruneberg, Michael M., *Understanding Job Satisfaction*, John Wiley and Sons, Ltd., New York, 1979.
- Herrick, Neal, "Cooperative Self-Interest: Learning from Joe Scanlon," *Public Productivity Review*, Vol. 6, No. 1-2, March/June 1982, pp. 19-34.
- Lawler, Edward, and Susan Mohrman, "Quality Circles after the Fad," *Harvard Business Review*, Vol. 63, No. 1, January/February 1985, pp. 65-71.
- Lawler, Edward, and Susan Mohrman, "Quality of Work Life," *Research in Personnel and Human Resources Management*, Vol. 2, 1984.
- Lawler, Edward, and David Nacler, "Quality of Work Life: Perspectives and Directions," *Organizational Dynamics*, Vol. 11, No. 3, Winter 1983, pp. 20-30.
- Likert, Rensis, *The Human Organization: Its Management and Value*, McGraw-Hill, New York, 1967.
- Lindell, M. K., J. T. Walsh, J. A. Drexler, and E. E. Lawler, *Effects of Technology on Experienced Job Characteristics and Job Satisfaction*, Battelle Human Affairs Research Center, Seattle, Wash., July 1980.
- Locke, E. A., et al., "The Relative Effectiveness of Four Methods of Motivating Employee Performance," in K. D. Duncan, M. M. Gruneberg, and D. Wallis (eds.), *Changes in Working Life*, John Wiley & Sons, Ltd., New York, 1980, pp. 363-388.
- Moe, Terry, "The New Economics of Organization," *American Journal of Political Science*, Vol. 28, No. 4, 1984, pp. 739-777.

Office of Personnel Management, Management Reports I-X, 1984-1987. Status of the Navy Personnel Management Demonstration Project.

Office of Personnel Management, Personnel Systems and Oversight Group, Research and Demonstration Division, *Implementation Report*, PACER SHARE Demonstration Project, Washington D.C., August 1989.

Orvis, Bruce R., James R. Hosek, and Michael G. Mattock, *PACER SHARE Productivity and Personnel Management Demonstration Baseline Evaluation*, RAND, R-3753-FMP, December 1990.

Orvis, Bruce R., James R. Hosek, and Michael G. Mattock, *Appendices to PACER SHARE Productivity and Personnel Management Demonstration Baseline Evaluation*, RAND, N-3146-FMP, December 1990.

Orvis, Bruce R., James R. Hosek, and Michael G. Mattock, *PACER SHARE Productivity and Personnel Management Demonstration: First-Year Evaluation*, RAND, R-3943-FMP, 1991.

Orvis, Bruce R., James R. Hosek, and Michael G. Mattock, *PACER SHARE Productivity and Personnel Management Demonstration: Appendices to First-Year Evaluation*, RAND, N-3257-FMP, 1991.

Orvis, Bruce R., James R. Hosek, and Michael G. Mattock, *PACER SHARE Productivity and Personnel Management Demonstration: Appendices to Second-Year Evaluation*, RAND, N-3404-FMP, 1991.

Patten, Thomas H., Jr., "Individual and Group Incentive Plans," in *Pay: Employee Compensation and Incentive Plans*, Free Press, New York, April 1977, pp. 386-437.

Power, R., *Guide for the Design and Implementation of Productivity Gain Sharing Programs*, Report No. DOD-5010.31-G, Deputy Assistant Secretary of Defense (Manpower, Installations and Logistics), Washington, D.C., March 1985.

Pratt, John, and Richard Zeckhauser, "Principals and Agents: An Overview," in *Principals and Agents: The Structure of Business*, Harvard Business School Press, Boston, Mass., 1987.

Public Law 95-454, "The Civil Service Reform Act of 1978," *U.S. Code Congressional and Administrative News*, Vol. 1, West Publishing Co., St. Paul, Minn., 1978, pp. 1111-1227.

- Roll, David, and Joyce Roll, "The Potential for Application of Quality Circles in the American Public Sector," *Public Productivity Review*, Vol. 7, No. 2, June 1983, pp. 122-142.
- Shapiro, Carl, and Joseph Stiglitz, "Equilibrium Unemployment as a Worker Discipline Device," *American Economic Review*, Vol. 74, No. 3, June 1984, pp. 433-444.
- Spence, Michael A., "The Economics of Internal Organization: An Introduction," *Bell Journal of Economics*, Vol. 6, No. 1, Spring 1975, pp. 163-172.
- Strauss, George, "Industrial Relations: Time of Change," *Industrial Relations*, Vol. 23, No. 1, Winter 1984, pp. 1-15.
- Thompson, Phillip, "Quality Circles at Martin Marietta Corporation, Denver Aerospace/Michoud Division," in Zager and Rosow (eds.), *The Innovative Organization: Productivity Programs in Action*, Pergamon Press, New York, 1982.
- Walton, M., *The Deming Management Method*, Putnam Publishing Group, New York, 1986.
- Walton, Richard E., "Work Innovations in the U.S.," *Harvard Business Review*, July/August 1979, pp. 88-98.
- Williamson, Oliver, *Markets and Hierarchies: A Study in the Internal Organizations*, Free Press, New York, 1983.
- Williamson, Oliver, "The Organization of Work: A Comparative Institutional Assessment," *Journal of Economic Behavior and Organization*, Vol. 1, No. 1, March 1980, pp. 5-38.
- Zager, Robert, and Michael P. Rosow, *The Innovative Organization: Productivity Programs in Action*, Pergamon Press, New York, 1982.